

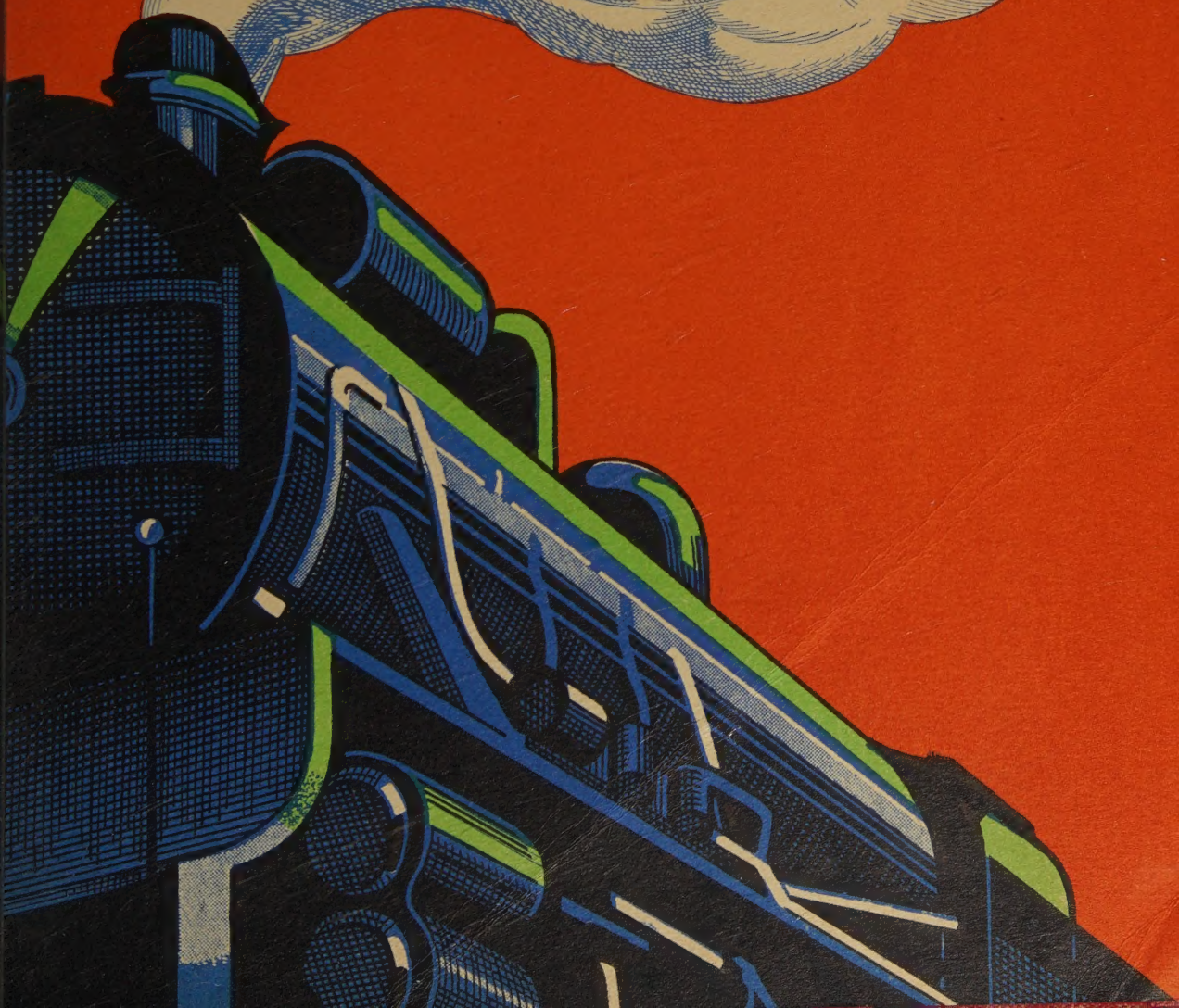
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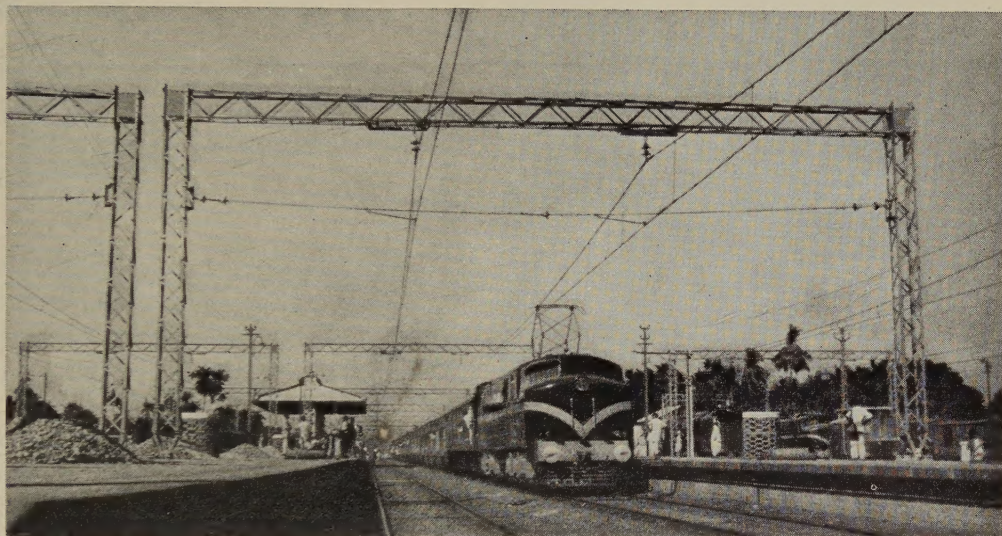
APRIL 1959.

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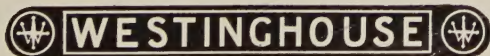
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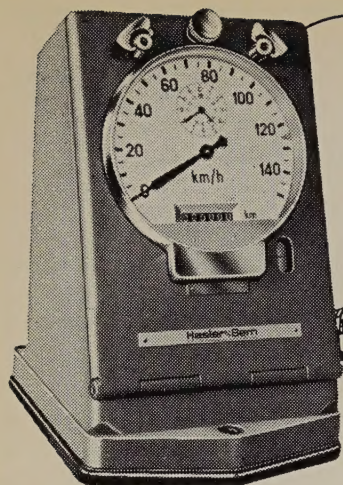
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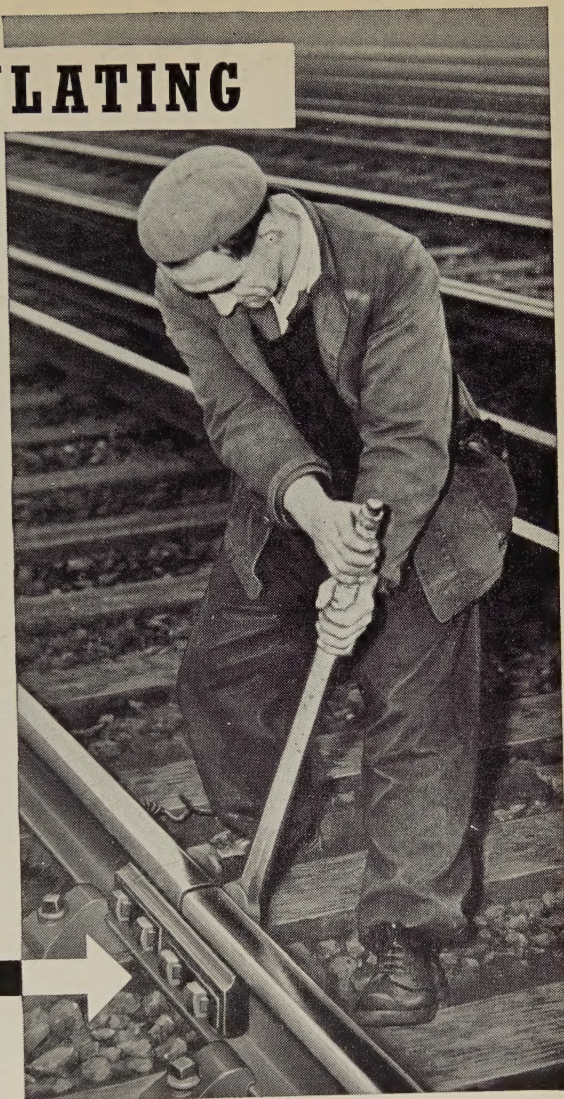
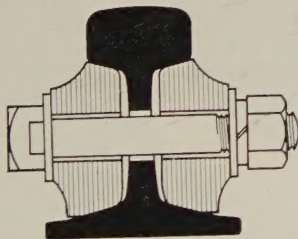
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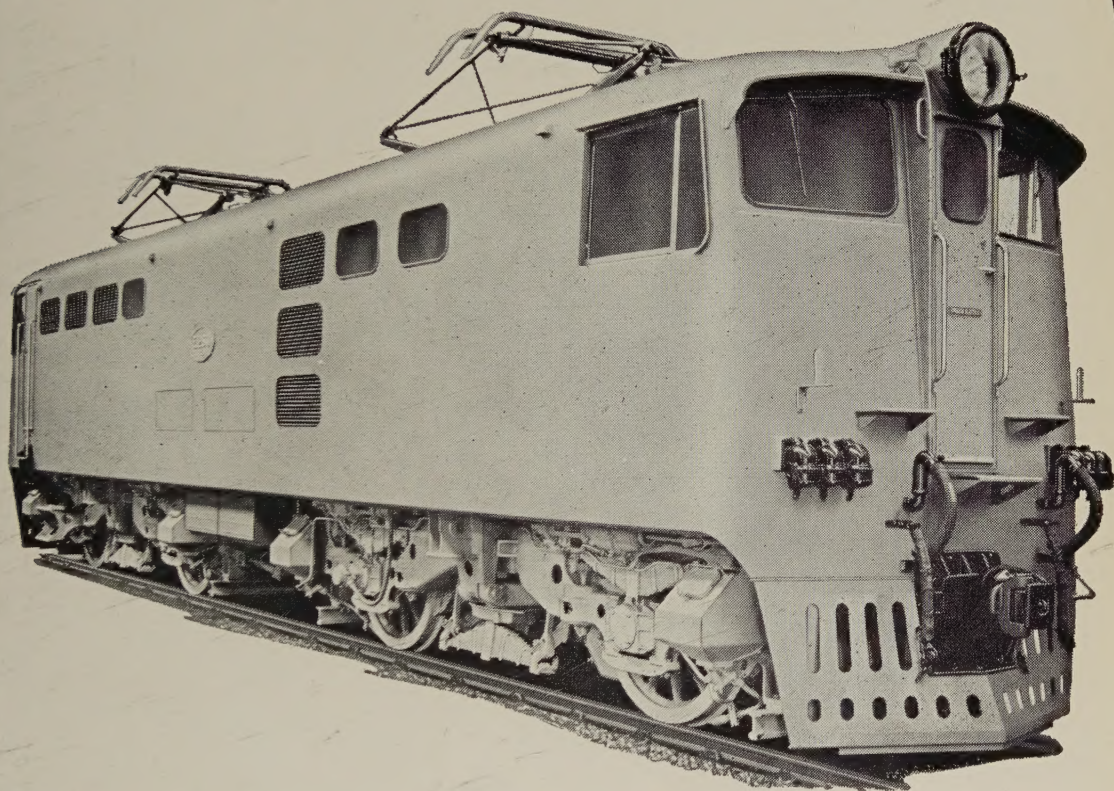
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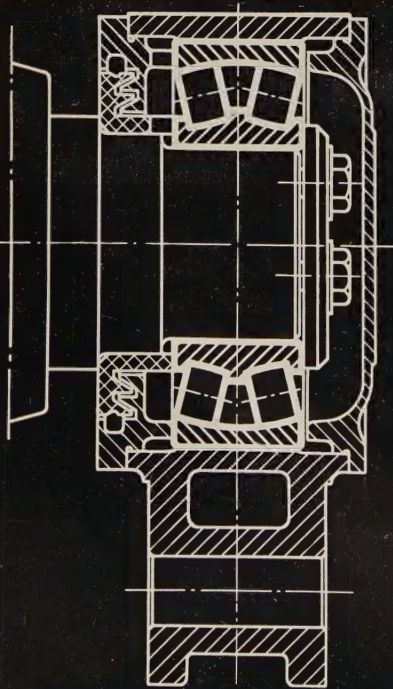
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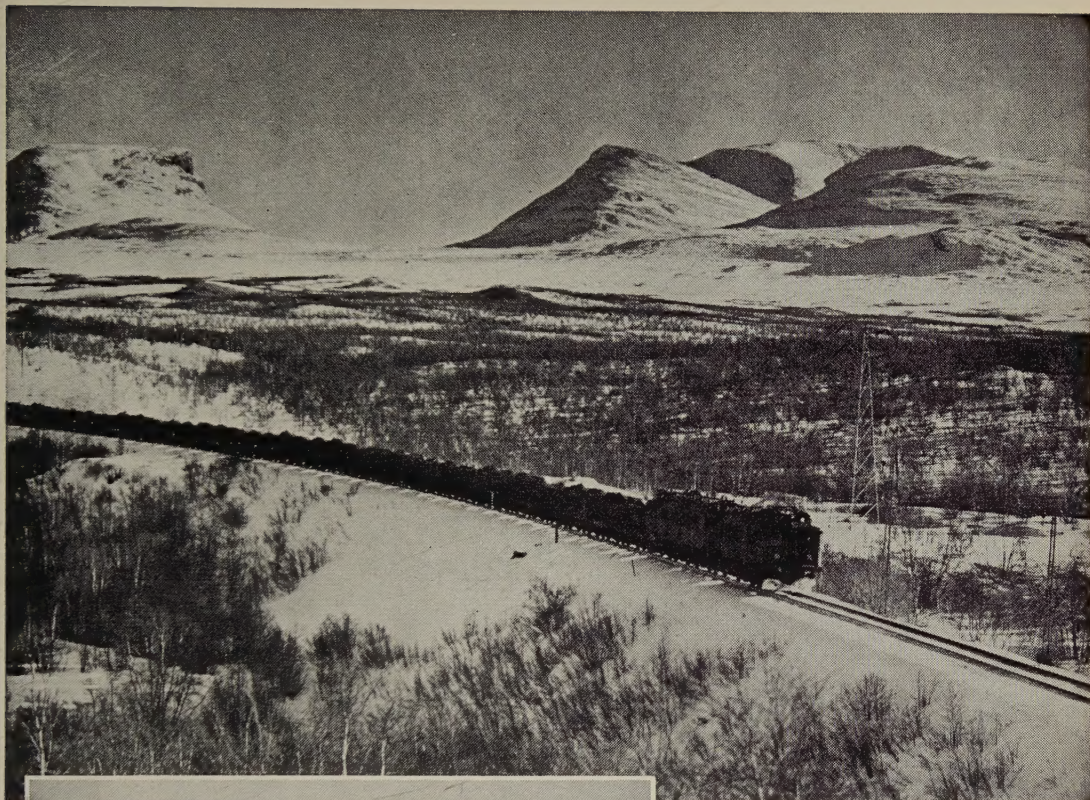
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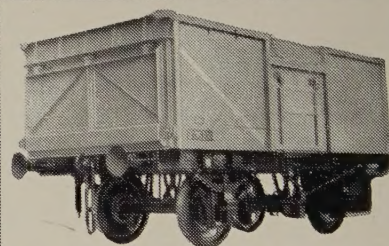
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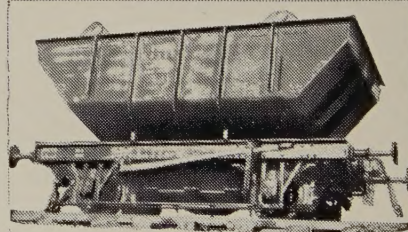
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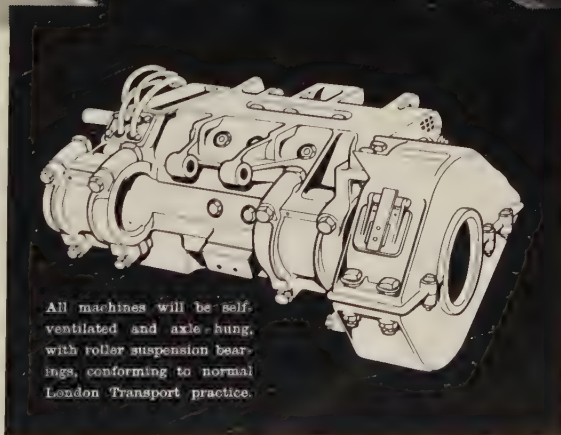
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OF THE

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(ENGLISH EDITION)

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An edition in French is also published.

BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

[385 (06 .112)

SEVENTEENTH SESSION

Madrid : 29th September to 7th October 1958.

GENERAL PROCEEDINGS

1st Section : WAY AND WORKS

INAUGURAL MEETING

September 30. 1958. at 9.30 a. m.

CHAIRMAN : F. PEREZ VILLAMIL

DEPUTY MANAGER OF THE SPANISH NATIONAL RAILWAYS (R.E.N.F.E.)

MEMBER OF THE PERMANENT COMMISSION OF THE ASSOCIATION.

— The meeting opened at 9.30 a.m.

The President (in French). — Gentlemen, the Permanent Commission has appointed me President for Section I. I am extremely honoured.

As a Spaniard and member of the R.E.N.F.E., I greet all the delegates very warmly and sincerely on behalf of the Spanish Railways. I hope you will find your sojourn in Spain a very agreeable

one; I may add that we have done everything in our power to make it so.

We will now elect the Vice-Presidents and Secretaries for our Section.

As Vice-Presidents, I suggest we elect :

Dipl. Ing. M. JACOBSHAGEN, Direktor der Hauptverwaltung der Deutschen Bundesbahn, Member of the Permanent Commission of the Association;

Mr. E.T. AALTO, General Manager of the Finnish State Railways, Member of the Permanent Commission of the Association; and

Mr. M. SAITO, Director of Foreign Department, Japanese National Railways, Member of the Permanent Commission of the Association;

and as *Principal Secretary* :

Mr. A. JACOPS, Chief Engineer of the Permanent Way Department of the Belgian National Railways.

(Applause and signs of approval).

— The Section, under the guidance of the PRESIDENT then completed the nomination of its officials and drew up its agenda.

QUESTION 1.

**Problems presented by the ageing of bridges and viaducts.
Long term effects of fatigue and corrosion in steel bridges
and weathering of masonry.**

Rational methods of maintenance of bridges.

Repair and strengthening.

Preliminary documents.

Report (America [North and South], Australia [Commonwealth of], Austria, Burma, Ceylon, Egypt, Western Germany, India, Irak, Iran, Republic of Ireland, Japan, Malaysia, New Zealand, Norway, Pakistan, South Africa, Sudan, Sweden, Union of Soviet Socialist Republics and the United Kingdom of Great Britain and Northern Ireland and dependent overseas territories), by Fr. LEMMERHOLD. (See *Bulletin* for May 1958, p. 639.)

Cambodia, Czechoslovakia, Denmark, Ethiopia, Finland, France and French Union, Greece, Hungary, Indonesia, Italy, Lebanon, Luxemburg, Netherlands, Poland, Portugal and overseas territories, Rumania, Spain, Switzerland, Syria, Turkey, Viet-Nam and Yougoslavia), by Dr.-Eng. G. CIVIDALLI. (See *Bulletin* for June 1958, p. 821.)

Special reporter : Dr.-Eng. G. CIVIDALLI
(See *Bulletin* for September 1958, p. 1333.)

Report (Belgium and Colony, Bulgaria

DISCUSSIONS BY THE SECTION.

Meeting of the 30th September 1958.

PRESIDENT : F. PEREZ VILLAMIL.

— The meeting opened at 9.45 a.m.

The President (in French). — Gentlemen, Question I, which you are now asked to discuss, deals with « Problems presented by the ageing of bridges and viaducts.

Long term effects of fatigue and corrosion in steel bridges and weathering of masonry. Rational methods of maintenance of bridges. Repair and strengthening. »

As you know, this question was the subject of very noteworthy reports by Dr. Ing.

G. CIVIDALLI, Inspecteur en Chef Supérieur du Service de la Voie et des Constructions des Chemins de fer de l'Etat italien, and Mr. F. LEMMERHOLD, Hauptverwaltungsrat, Referent für Brückenangelegenheiten in der Hauptverwaltung der Deutschen Bundesbahn.

In addition, Mr. CIVIDALLI was good enough to prepare the special report. I invite him to join us on the platform.

As you will all have made yourselves familiar with these reports, I suggest that we immediately begin to discuss the Summaries submitted, which Mr. JACOPS will now read to you.

(The English text of the Summaries was read by Mr. GLENDINNING, Secretary).

M. Jacops. — *Summary No. 1 :*

1. It is not possible to foretell the life of a bridge when building it solely on the experience acquired from observing existing bridges.

Best quality materials, the most careful methods of calculation, and new constructional methods lead us to think that the life of new metal and reinforced concrete bridges will be very long, provided they are suitably maintained.

The importance, from the economic point of view, of the life of a bridge is generally not very great and the choice of a type of bridge when it is being planned is determined by other more imperative considerations : cost, operating requirements, maintenance costs.

Mr. Hoorweg, Netherlands Railways. — Mr. PRESIDENT, I will point out that in Summary No. 1 it is said that from the economic point of view the importance of the life of a bridge generally is not very great and that the choice of a type of bridge is determined by other more important considerations: costs, operating

requirements, maintenance costs. It is rather, in our opinion, that a bridge has to be considered from many aspects, and when we make our choice of a certain type of bridge we consider aesthetics. It is therefore proposed we should add to the more important considerations, « aesthetics ».

Mr. R. Lévi, French National Railways (In French). — Mr. PRESIDENT, I should like to make a remark about the same paragraph; I think the wording of the French text does not exactly convey the meaning of the Reporter.

It is stated indeed that « From the economic point of view the importance of the life of a bridge is generally not very great... » I think this expression might be ambiguous, and suggest we state more definitely that « The difference in the costs of construction of a bridge according to whether it is required to have an average or long life is generally small. The choice of the type of bridge when projected is therefore determined... »

If the summary is adopted in this modified form, I do not think it would be necessary to enumerate the other more important considerations; this would also make it possible to take Mr. HOORWEG's remarks into account.

Moreover, if we repeated « ... other more important considerations : cost, operating requirements, maintenance costs » it would be difficult to understand...

The President (in French). — Does everyone agree to this suggestion? (*Agreed*). Consequently Mr. HOORWEG's remark need not be included.

Mr. Jacops, Principal Secretary (in French). — The third paragraph of Summary No. 1 will therefore read :

« The difference in the cost of constructing a bridge whether it is required to have an average or long life is generally small. The choice of a given type of bridge is therefore determined by other more important considerations. »

The President (in French). — Are there any other remarks about this Summary?

Mr. A. Dean, British Railways. — I am not clear how we have left Summary No. 1 yet. May we have it in English please as finally adopted?

Mr. Jacops. — Mr. Lévi's point of view is this. He suppresses the words « The importance from the economic point of view » and simply says « The difference between the construction cost of a bridge according to its estimated life be it medium or long is generally not important. »

Mr. Dean. — Not very great, yes.

Mr. Cividalli, Special Reporter (in French). — I will not say that the difference is small, but that the importance of such a difference is of no account.

Mr. R. Lévi (in French). — In the third paragraph of Summary No. 1, you are in fact considering the repercussions.

I agree, but in this case the word « importance » gives the impression that there is no need to bother about the life of a bridge.

Might not this be a mistake?

The President (in French). — Have you any other remarks to make, Gentlemen?

Mr. Cividalli (in French). — Yes, but when it is a question of bridges which have been designed for as long a life as possible, it is consequently of little importance from the economic point of view whether the life of such bridges is 90, 100 or 200 years, at the present time.

Mr. R. Lévi (in French). — Why is it of little importance?

Mr. Cividalli (in French). — Simply from the financial point of view; I am thinking of the cost of the capital to be invested today, and the cost of the capital invested in 90 or 200 years time.

Mr. R. Lévi (in French). — According to you, what must be taken into account at the time the bridge is built, is the length of the financial amortisation of the bridge.

I do not think there is a single Railway which bases the calculation of its financial charges on such a basis. There is always a conventional acceptance.

Mr. Cividalli (in French). — But how about the real financial point of view?

Mr. R. Lévi (in French). — Gentlemen, I hope you will excuse this dialogue.

I thought that you meant that it was the actual cost of building which was but little affected by the length of life of the bridge. In fact, this is a point which could be stressed : it costs no more to build a bridge which will last 100 years than one which will only last 40 years; the difference is negligible.

Mr. Cividalli (in French). — That is not my opinion.

I mean the actual amortisation period, not the conventional one.

Mr. R. Lévi (in French). — Perhaps, it would be advisable to be more precise; I took it in another way.

Mr. Cividalli (in French). — I did not notice it until Mr. DEAN made his observation.

Mr. Dunton, *London Transport Executive* — I believe the economic importance is always great. I think we should not say that the economic importance is not great, or not very great. In my opinion, the economic importance is always very great, but frequently it is not dominant over other considerations as mentioned by Mr. LÉVI.

Mr. Jacops (in French.) — The economic importance is always great, but not necessarily the main factor?

Mr. Lévi (in French). — We have all interpreted Mr. CIVIDALLI's opinion differently. I wish he would tell us exactly what he wants.

Mr. Cividalli (in French). — I think that the French National Railways are really of the same opinion; do you not say in fact when choosing the type of bridge, its construction is considered after...? To arrive at such a conclusion, little importance must be attached, I think, to the first consideration.

Mr. R. Lévi (in French). — I suggest the following text :

« The influence of the duration of life of a bridge on the financial charges which this involves is, in general, not great... »
Let us say *influence*, not *importance*.

Mr. Dean. — If you take bridges one by one, it is true. If you take thousands, it is not true.

Mr. Dunton. — I think it is too short a statement. I would prefer « they are often or generally dominated by other considerations ».

Mr. Jacops. — It is said « cost, operative requirements, maintenance costs » and we are adding « aesthetics ». Then we can maintain this part of the phrase like it is, but the first words would be changed and we would say, « The influence of the duration of life of a bridge on the financial charges that it involves is generally not very great ». It is only the first part that is to change.

Mr. Dunton. — I feel it is too short a statement.

Mr. Jacops. — Even with the end of the Summary?

Mr. Dunton. — Yes, I feel it is too short to say that it is generally so. It would be better to put the two things in opposition. While the economic position is important, it is not generally the dominant consideration.

Mr. Jacops. — The meaning is this. If in the calculations, the financial charges

are spread, for example over 80 or 100 years, there is not normally any difference. This is the only meaning.

Mr. Dunton. — Yes, that relates to a difference in life between long and very long, but not, I think, between medium and very long.

Mr. Jacops. — The idea of Mr. LÉVI was between medium and very long.

Mr. Dunton. — I think it would not be true between medium and long, but between medium and very long.

Mr. Glendinning. — Would Mr. DUNTON agree to « While the importance from the economic point of view of the life of a bridge is considerable it is not generally the dominant factor, which is determined by, etc., etc... »

Mr. Jacops (in French). — The text will read as follows :

« The influence of the duration of life of a bridge on the financial charges it involves is generally small, and the choice of the type of bridge when projected is determined by other more important considerations : cost, operating requirements, maintenance costs. »

Mr. R. Lévi. — No, no.

Mr. Cividalli (in French). — I think Mr. R. LÉVI is quite right when he suggests to give up these three suggestions, because there would be many others to be retained.

Mr. Jacops (in French). — The text will therefore read :

« The influence of the duration of life of a bridge on the financial charges which this involves is, in general, not great and the choice of a type of structure to be decided upon is determined by more important considerations. »

The President (in French). — Are you satisfied, Gentlemen, that this new text should be adopted? (*Adopted*).

— *The text adopted for Summary No. 1 was as follows :*

« It is not possible to foretell the life of a bridge when building it solely based on the experience acquired from observing existing bridges.

« Best quality materials, the most careful methods of calculation, and new constructional methods lead us to think that the life of new metal and reinforced concrete bridges will be very long, provided they are suitably maintained.

« The influence of the duration of life of a bridge on the financial charges which this involves is, in general, not great, and the choice of a type of structure to be decided upon is determined by more important considerations. »

Mr. Jacops. — *Summary No. 2 :*

2. Several Administrations fix the budget allocations for maintenance and renewal as a function of the total value of the bridges; but most of them determine these sums from the condition of the bridges and the experience they have acquired, taking into account their financial possibilities, which often make it impossible to carry out the maintenance work properly.

The President (in French). — This is a very interesting summary. We must indeed recognise the fact that in general

bridges have not yet had time to age, but that special circumstances have led to their renewal, etc... For example in Spain, more than 150 bridges have been renewed in the last ten years, not because they were old, but because the loads had become greater than what they could carry.

Have you any remarks to make about this summary, Gentlemen?

Mr. Dean. — I would prefer the last few words to be altered to say « which often make it impossible to carry out all the maintenance work falling due ».

Mr. Jacobs (in French). — So that part of the sentence which reads... « which often make it impossible to carry out the maintenance... » would be changed to : « ... which often make it impossible to carry out all the maintenance work which had become necessary. »

Mr. Unal, Secretary (in French). — We should say « ... que l'état des ouvrages... »

The President (in French). — Do you agree, Gentlemen? (*Agreed*).

— *The text of Summary No. 2 will therefore become :*

« 2. Several Administrations fix the budget allocations for maintenance and renewal as a function of the total value of the bridges; but most of them determine these sums from the condition of the bridges and the experience acquired, taking into account their financial resources, which often make it impossible to carry out the maintenance work which had become necessary. »

Mr. Jacobs. — *Summary No. 3 :*

3. The progressive increase in the loads generally makes it necessary to check by calculation existing metal bridges in order to decide if they can take the new loads proposed.

The opinions of the Administrations differ as to the proper interpretation of the technological tests which have been carried out on elements from old metal bridges. The stress limits allowed for such bridges vary considerably from one Railway to another.

The President (in French). — The Administrations expressed their opinions, but it was difficult to come to any conclusion.

Mr. Portmann, Swiss Federal Railways (in French). — **Mr. President**, I would like to ask a question to **Mr. CIVIDALLI, the Special Reporter**.

Would it not be advisable to give here, in Summary No. 3, or at the beginning of the Summaries, a review of the more important causes for the deterioration of metal bridges?

We could say that the most important causes of deterioration in metal bridges are as follows : corrosion, faults in design, which result in exaggerated local stresses or increased corrosion.

As far as fatigue is concerned, opinions are divided. It would appear, however, that certain cracks, which have appeared at places where there is excessive stress, would not have occurred had these stresses been permanent.

I am making a suggestion; this text might be included at the beginning of Summary No. 3.

Mr. Cividalli (in French). — **Mt. PORTMANN**, I do not think there would be any objection to including this text, but these observations have already been made in the Special Report.

The Summaries have to be concise, that is why we did not go back to this idea; however, if the Meeting considers that it is advisable to modify the Summaries in this way, I do not see anything against it.

Mr. R. Lévi (in French). — I am wondering, **Mr. PRESIDENT**, whether, if the Meeting considers it advisable to adopt the observations made by **Mr. PORTMANN**, these should be included in Summary No. 3. I am not certain about this.

On the other hand, I think it would be difficult to take sides on the question of fatigue, as this is such a controversial point.

Mr. Dean. — Is it not a subject for four years' hence? When there will be more information to talk about it then.

The President (in French). — Do you agree, **Mr. PORTMANN**?

Mr. Portmann (in French). — All the same, would it not be a good thing to say something about it?

When in ten or twenty years time, you read this report again, you will pay attention more particularly to the summaries, and it is probable that you will not read either the *Special Report* nor the other reports. That is why I am making this suggestion. Naturally, if the Meeting does not agree, I will not insist...

Mr. R. Lévi (in French). — I suggest we settle the following point : Should the precisions mentioned by **Mr. PORTMANN** be included in Summary No. 3 or should these be the subject of a new summary? Perhaps, it is useful to include this question in the general summaries. Summary No. 3 deals with the calculations and perhaps it is not the right place for such precisions; may be they should be given an additional summary.

Mr. Portmann (in French). — Agreed.

The President (in French). — We can draw this up immediately.

Mr. R. Lévi (in French). — It might be added to Summary No. 5.

Mr. Julien, *Ministry of Public Works, Transport and Tourism, France* (in French). — I think the Summaries should be concise and first of all we must decide whether **Mr. PORTMANN**'s suggestion is to be adopted or not.

Mr. Carpentier, *French National Railways* (in French). — For **Mr. PORTMANN**, I should like to point out that Summary No. 5 tends to answer this question, since it enumerates the different causes of deterioration : defects in design, corrosion, lack of maintenance and other causes.

Some mention might be included in this general summary No. 5 to cover **Mr. PORTMANN**'s suggestion.

The President (in French). — Any other remarks?

Is Summary No. 3 to be considered as adopted? (*Agreed*).

— *The original text of Summary No. 3 was therefore adopted.*

Mr. Jacops. — *Summary No. 4 :*

4. To examine metal bridges the Administrations generally make use of sounding by hammer in the case of rivetted assemblies, and measuring the deflections and stresses as well as the use of X rays to check the welds. New processes, such as those based on ultrasonic equipment or magnetisation have already been given a trial on several Railways.

The President (in French). — No remarks, Gentlemen?

— *Summary No. 4 was adopted unaltered.*

Mr. Jacops. — *Summary No. 5 :*

5. Good conservation of metal bridges necessitates above all protection against corrosion, which occurs especially at those points which are difficult of access, exposed to dirt, insufficiently ventilated, or likely to collect water.

Consequently, when designing new bridges it is essential to select smooth, simple designs, and adequate constructional arrangements; in addition bridges should be maintained regularly.

Mr. Glendinning. — For better translation of the English text, the word « conservation » should read « preservation ». Before discussion perhaps the English speaking delegates would agree to this suggested alteration of the word « conservation » to « preservation ». (*Agreed.*)

Mr. R. Lévi (in French). — This would be the place, Mr. PRESIDENT, to consider Mr. PORTMANN's suggestion.

If Mr. CIVIDALLI agrees, this suggestion might be included in this Summary.

Mr. Dunton. — We could say, « Failures due to these causes are summarised as follows : —... »

Mr. Carpentier (in French). — The different causes should be mentioned. It is not enough just to speak of corrosion.

Mr. Cividalli (in French). — The Swiss Railways consider that fatigue occurs wherever there are exceptional stresses; on the other hand, the Italian State Railways are concerned with the static stresses.

Mr. R. Lévi (in French). — Mr. PRESIDENT, I wonder if it would not be best to set up a Wording Committee to consider this point, consisting of Messrs. CIVIDALLI, PORTMANN, DUNTON and CARPENTIER, seeing that as you said just now, it would not be advisable to raise the question of fatigue on which opinions are divided.

Mr. Ivanovic, Yugoslavian Railways (in French). — I suggest saying : « Consequently, in the case of new bridges, smooth and simple structures should be chosen, and adequate constructional arrangements, and, whenever possible, use should be made of welding and not rivetting. »

Mr. Cividalli (in French). — I do not think that would be the opinion of most Administrations; I doubt if they would agree to such a summary : it would be going too far...

Mr. Dean. — The words « where possible » may not make it too difficult. I think perhaps « wherever appropriate » would be better.

Mr. R. Lévi (in French). — I agree with Mr. CIVIDALLI. I think, however, that we might meet Mr. IVANOVIĆ by stating that in certain cases this consideration results in welding being preferred to rivetting.

Mr. Carpentier (in French). — In many cases, it is possible to use thick sections which do not require much welding.

Mr. Dehaen, *Belgian National Railways* (in French). — No mention is made of smoke from the locomotives as a cause of corrosion. Should we not say in the first paragraph : « ... exposed to dirt and smoke, with insufficient ventilation or defective drainage. » This is an important cause of corrosion.

Mr. R. Lévi (in French). — To dirt or to smoke : never both together.

— *A new text for Summary No. 5 will be prepared by the Wording Committee and submitted to the Section at the next Meeting.*

The President (in French). — We will go on to the next summary.

Mr. Jacops. — *Summary No. 6 :*

6. Careful painting and regular repainting, carried out after proper preparation of the surfaces (hammering, scraping with metal brushes, in difficult cases descaling by sand jet and sometimes burning off) are the most currently used methods for protecting metal bridges against corrosion.

In general, the paint used is the classic red lead, iron, or chromate of zinc paint (undercoats) and white zinc, white lead, iron oxide, and aluminium paints, or those with a bitumastic or tar base (protective paints).

It is not yet possible to formulate any valid

opinions concerning the trials made of special paints based on new formulae (with a vinylitic resin base, lead-metal, chlorated rubber, etc.) which some railways have started to use.

Mr. Cividalli (in French). — I do not think this summary calls for any comment.

Mr. Carpentier (in French). — I should like to call your attention to a matter of detail.

In the first paragraph, you mention as methods of preparing the surfaces, hammering, scraping with metal brushes and in difficult cases descaling by sand jets and sometimes flame cleaning. Perhaps, it cannot be affirmed systematically that this applies to « difficult cases » ?

Mr. Cividalli (in French). — I think Mr. CARPENTIER is right; the terms « difficult cases » referring only to repainting. The distinction should be made between painting and repainting.

The President (in French). — What do you suggest ?

Mr. Carpentier (in French). — Leaving out the words « in difficult cases ».

Mr. Cividalli (in French). — All the same, I do not think it would be advisable to suppress simply these words; it is true that most of the Administrations make use of descaling by sand jets, but not all. It would not be fair to be so categorical. I would say : « Often... »

Mr. Carpentier (in French). — It is an enumeration, it is not a choice, is it ?

Mr. Cividalli (in French). — Under these conditions, we might say : « Often descaling... »

Mr. Jacops (in French). — So that the words « Under difficult conditions ... » would be replaced by : « *often*, descaling... »

Mr. Cividalli (in French). — That would not be right!

Mr. Carpentier (in French). — It is an enumeration.

Mr. Cividalli (in French). — It would be better to leave out the words « in difficult cases... »

Mr. Lohmann, *Netherlands Railways*. — Up to recently, in Holland, descaling by sand jet was the most currently used method of preparation of surfaces of steel, but lately we have been forbidden by the Government Act 1957 because of the danger of silicosis causing disease of the lungs. At present, another material is used. It is not known what the result will be. It is proposed to say in the Summary, therefore, « in difficult cases descaling by sand jet, steel jet, or with grains of sand free from silicon ».

Mr. Dunton. — In English I am sure the point would be covered by saying « sand or shot blasting ». I don't know the French for « shot ».

Mr. Carpentier (in French). — We could simply say : descaling by sand jets —, nothing else.

Mr. R. Lévi (in French). — It might be « shot ».

Mr. Jacops (in French). — « By jet » — that is too vague...

A delegate. — « Steel particals »?

Mr. Lemmerhold, *Deutsche Bundesbahn (Reporter)*. — I think we should accept what the Netherlands Railways say because in Germany we use also steel especially in workshops but outside it is more expensive to use it than sand jet.

Mr. Julien (in French). — « Steel shot » or « Sand jet »?

Mr. Jacops (in French). — We will therefore say :

« ... scraping with wire brushes, descaling by sand jet or steel shot » and leave out the words « in difficult cases »?

Mr. Williams, *Malayan Railway Administration*. — **Mr. CHAIRMAN**, would it not be better to say « sand or other forms of cleaning by blast », then you could put « or steel », anything you like, but so few Administrations are restricted from using sand blast. I think most countries use sand blast. We do in Malaya. There has never been any opposition on medical grounds. So if the objection is just to « sand », if we could say « cleaning by sand or other forms of cleaning by blasting » this would cover it. It occurs to me that this use of sand blast is turned down on medical grounds and nothing else. I do not think we should put in specifically « sand » or « shot ». If we

cannot translate it into English we should try some other wording. « Sand or other material used in blasting ».

Mr. Carpentier (in French). — In the French text it would be sufficient to say « by sand jets or others ».

Mr. Williams. — It is the material which differs not the form.

Mr. Alexander, Nigerian Railway Corporation. — I agree entirely with what **Mr. WILLIAMS** said. I think we are getting confused in the wording. I would propose « descaling by sand jet or jetting by other materials ».

Mr. Julien (in French). — « Other materials » might mean lumps of rock.

Mr. Jacops (in French). — I think we are all in agreement, **Mr. President**.

Mr. Dehaen (in French). — I find the word « brûlage » (*burning*) is not very appropriate, because it is not question of burning anything but of causing a sudden change of temperature which breaks off rust. I suggest replacing the word « brûlage » by « décapage à la flamme ».

Mr. Dean. — « Flame cleaning » in English.

Mr. Jacops (in French). — We will therefore say : « ... and sometimes by flame cleaning... »

The President (in French). — I think everyone agrees? (*Agreed*).

Mr. R. Lévi (in French). — **Mr. PRESIDENT**, I would like to raise two points, but do not know whether these would have any effect on the wording of the summaries.

I would like to ask the Special Reporter whether it appears from the enquiries made by the Reporters that painting in the shops with several coats of paint is to be recommended or not.

Mr. Cividalli (in French). — Most of the Administrations replied that the first coat was given in the shops and the second on site.

Mr. R. Lévi (in French). — That is not the general practice. I am simply asking the question as I think it is rather important that it should be mentioned in the Summaries.

Mr. Cividalli (in French). — In Summary No. 6, it will be necessary to make a distinction between painting and repainting.

Mr. R. Lévi (in French). — Perhaps. There is another point, which has something to do with it, which I should like to raise; but I repeat, I am not sure whether it should be taken into account in the text of the Summary.

I am struck by the fact that certain Administrations willingly accept paint with a bituminous or tar base; in France, such paints have never given good results. The Administrations using these methods, are they careful to sand the work before the first coat in the shops? I would like to know if there is any connection between the two things : painting in the shops

after sanding and the use of bituminous paints?

Mr. Cividalli (in French). — In general, bituminous paint is used for the finishing paint.

Mr. R. Lévi (in French). — In this case, there is nothing to find fault with. I have not spoken.

Mr. Jacops (in French). — Are we going to include Mr. Lévi's point in this Summary? In this case, the Wording Committee might prepare a new text this afternoon. (*Agreed*).

— *The Wording Committee previously mentioned is charged with amending the text of Summary No. 6.*

Mr. Jacops. — *Summary No. 7:*

7. In the opinion of most of the Administrations in the case of riveted structures, surfaces permanently in contact should be protected by a coat of paint.

In the case of welded structures, on the contrary, this practice may be given up owing to the compacity of the welds.

In addition, it is recommended not to cover these surfaces with paint when high tensile bolts are used for assembly.

Mr. Carpentier (in French). **MR. PRESIDENT**, I suggest to add at the end of the first paragraph (French text) after the words «in permanent contact» the words «*if special precautions are not taken in connection with the riveting.*»

In fact, in France, we forbid painting the surfaces in permanent contact, but we have very strict requirements about riveting.

Mr. Cividalli (in French). — The spaces between rivets which you make use of in France do not differ very much from those used by most Administrations, who consider it necessary to coat the surfaces with paint.

Mr. Carpentier (in French). — After Mr. CIVIDALLI's explanation, I withdraw my suggestion.

In the second paragraph it says : « With welded structures on the contrary, this practice can be given up owing to the compacity of the welds. » I would like to say : « ... *this practice can be given up when the parts in contact are assembled by continuous welding.* » This is not always the case.

Mr. Jacops (in French). — « ... when the parts in contact are assembled by *continuous runs of welding.* » (Repeated in English)

Mr. Dean. — I think it is in most cases. I don't think it needs limiting. I would suggest the paragraph in English should read « In the case of welded structures, on the contrary, this practice may be given up ». Stop there. The point is that with the heating of the welding any preparation you put inside melts with the welding.

Mr. Dunton. — Perhaps it may be given up in the vicinity of the welds. It might not be given up altogether.

Mr. Jacops (in French). — What do you think. **MR. CIVIDALLI?**

Mr. Cividalli (in French). — Personally, I agree with **MR. CARPENTIER**.

Mr. Dean. — « When the pieces are narrow and assembled. »

Mr. Jacops. — He does not like the expression : « When the parts are narrow », *then in French* : suppress the words « owing to their compacity » and say : « this practice can be given up when the parts in contact are narrow — or not wide? — and assembled by runs of welding »?

Mr. Cividalli (in French). — In Germany, we saw some elements in box form. I think we should retain Mr. CARPENTIER's suggestion.

Mr. Dunton. — I think it is often given up in other cases than continuous welding.

Mr. Dean. — I think Mr. CIVIDALLI by continuous welding means as opposed to intermittent welding. I thought in the first place he meant continuous process welding.

Mr. Jacops (in French). — Is there not some misunderstanding?

You spoke of continuous welds; you are not thinking of the welding method, but the resulting continuity?

Mr. Carpentier (in French). — Naturally.

Mr. Jacops. — Mr. CARPENTIER means that the completed weld is continuous; it need not be so whilst it is being made. Do all the delegates agree that we should say : « when the parts in contact are assembled by continuous welds »? Can Summary No. 7 be adopted? (*Agreed.*)

So it is proposed to word the second paragraph as follows : « In the case of welded structures, on the contrary, this practice may be given up when the surfaces in contact are assembled by continuous welds. »

The President (in French). — Do you agree, Gentlemen? (*Agreed.*)

— *The text adopted for Summary No. 7 reads as follows :*

« 7. In the opinion of most of the Administrations in the case of riveted structures, surfaces permanently in contact should be protected by a coat of paint.

« In the case of welded structures, on the contrary, this practice may be given up when the surfaces in contact are assembled by continuous welds.

« In addition, it is recommended not to cover these surfaces with paint when high tensile bolts are used for assembly. »

Mr. Jacops. — *Summary No. 8 :*

8. Where local conditions are particularly unfavourable, it is necessary to repaint every two years, whereas intervals of 30 to 40 years between repainting may be possible in certain mountain districts where the air is pure and dry.

Partial repainting makes it possible to increase the intervals between two complete overhauls.

Mr. R. Lévi (in French). — In the case of statistics, the expression « mean value » is often used, i.e. that which is exceeded in 50 % of the cases and not reached in 50 % of the cases. I think it would be of value, if it so appears from the summaries of the reports, to mention this mean value. All that we know is that the cycle

lies between 2 and 40 years, but is it possible to say that it occurs at about 2 or 9 years from the replies received as a whole?

Mr. Cividalli (in French). — We have not any way of giving an answer, but I can express my opinion as a result of the information obtained, which is that on the average the period between successive repainting is 9 to 10 years. This is only my personal impression and not a formal conclusion.

Mr. R. Lévi (in French). — It is better than nothing!

Mr. Dunton. — I think it would be between five and ten years. I think it could be useful to mention it in the Summary.

Mr. Lemmerhold. — In the answers from the English speaking countries a medium of 10 to 15 years was revealed, and that is the same as we adopt in Germany. Also we take the 10 to 15 years and it seems here possible to give such a medium. It is different from answers of other Administrations; the Americans have 15 to 20 years, and some other railways 30 years.

Mr. Jacops (in French). — Everyone wants to see some indication given about this mean value. Do you agree, Mr. CIVIDALLI?

Mr. Cividalli (in French). — No, I do not agree. I do not think it is possible.

Mr. Dunton. — We could say ten years is a fairly common average.

Mr. Cividalli (in French). — The Danish Railways mentioned 2 to 3 years.

Mr. R. Lévi (in French). — Undoubtedly, the different Administrations are faced with very different climatic conditions; Denmark obviously has to protect her bridges more often than some of the countries on the continent, but I do think some mean value might be given for the Administrations as a whole.

Mr. Jacops (in French). — That comes to saying that for the Railways as a whole it is...

Mr. Julien (in French). — ... say about ten years?

Mr. Cividalli (in French). — Personally, I do not see the value of such information; it would only apply to certain Administrations, perhaps the French, the Italian and the R.E.N.F.E.? As for other countries, like Denmark, Finland, Switzerland, conditions are not the same.

Mr. R. Lévi (in French). — May I make my idea more precise. In the proposed summary it is stated: « Where local conditions are particularly unfavourable... » then, goes on to mention the case of « Certain mountain districts where the air is pure and dry. » We go from one extreme to the other, there is no question of the average.

We might first of all mention the ordinary cases: « In most cases... » or again « For the Administrations as a whole, the average cycle for repainting is 5 or 10 years, however... »

Mr. Dunton. — Perhaps we could say « for many Administrations the period would be not far from ten years ».

Mr. Egbuna, Nigerian Railway Corporation. — In saying « For various Administrations the average figure is ten years » that is only for temperate countries. In the tropics five to six years, and in temperate climates ten to fifteen years.

Mr Dunton. — Is it proposed to leave the rest of the sentence in « Where local conditions are particularly unfavourable, etc. » and then add that point saying in a new phrase « For many Administrations the average period is about ten years », then to continue as before « Whereas intervals of 30 to 40 years between repainting may be possible in certain mountain districts where the air is pure and dry ». That, I think, would meet Mr. EGBUNA's point of the different temperatures, the tropics and the temperate climates.

Mr. Carpentier (in French). — I would prefer to speak of conditions; even in temperate regions the bridges may be very exposed, for example in London.

Mr. Egbuna. — What I really mean is that the whole of this sentence should be retained and we put it right afterwards. We mention the difference between tropics and temperate climates; then we leave in the whole of the first sentence, so that covers the whole thing. When I say that the average number of years in the tropics is 5 to 10 and in the temperate climates is 10 to 15, I would like that put in and the sentence left as it is.

Mr. Jacops (in French). — The suggestion is therefore to maintain the sentence as it is but to add two mean values, one for tropical countries of about 5 or 6 years, and one for temperate countries of 10 to 12 years.

Mr. Williams. — I have worked in the Sudan and in Malaya. In the tropics and in the Sudan you can go for twenty years where you have dry air, and in Malaya with heavy rainfalls we need to paint every 5 years, and I think the words « local conditions » cover adequately what is required, and I think it would be very wrong to say « in the tropics 5 to 10 years and in temperate climates 10 to 15 years ». Just say, « local conditions » and that will cover it.

Mr. Egbuna. — What I am saying is that if you are to change this and add something about an average period of 10 to 15 years, it is not an average at all. In favourable conditions we have a period of up to 30 years, in certain places, but in others in the tropics, not so favourable, we paint every two years.

Mr. Cividalli (in French). — Here are the replies I got from the different Administrations about the average period between two repaintings :

Belgium — 5 years;

Lower Congo to Katanga Railway — 5 years;

O.T.R.A.C.O. — 5 years;

Denmark — 10 years in the eastern part of the country; 5 to 6 years in the west;

Spain — 5 years;

Finland — 15 to 20 years;

France — 5 years near the sea; 12 years or more in mountainous regions;
Algeria — 7 to 10 years;
Cameroons — 8 years;
French West Africa — very variable;
Ethiopia — 5 years;
Viet-Nam — 4 years;
Hungary — 8 years;
Italy — 10 years;
Luxemburg — 5 years;
Netherlands — 5 years to 10 years;
Portugal — 4 to 10 years;
Switzerland — minimum 15 years; maximum 40 years;
Czechoslovakia — 6 to 10 years;
Jugoslavia — 5 years.

I really do not think, at least this is my personal opinion, that any mean value can be taken from these answers.

The President (in French). — Gentlemen, I think that in view of what the Special Reporter has told us, the text should be left as it is — we cannot get everyone to agree.

Do you agree, Gentlemen, that Summary No. 8 should be adopted in its original form? (*Agreed*).

— *Summary No. 8 is adopted without modification.*

Mr. Jacops. — *Summary No. 9:*

9. Methods of protecting metal structures other than painting (metallisation, cathodic protection, use of rustless steel and other metals or alloys) have only been used in special cases.

Encasing in concrete metal parts exposed to the smoke from locomotives is the current practice on certain Railways; in particular mention must be made of the use of pre-fabricated concrete or asbestos cement components, which appear to give complete satisfaction.

The President (in French). — I think, Gentlemen, that you are all agreed about this Summary? It would be difficult to find another text for this point.

Mr. Dean. — Might it not be wiser to make it more indeterminate by omitting the last but one word of the Summary, that is the word « complete »?

Mr. Carpentier (in French). — In French, there is not much difference between « gives satisfaction » and « gives full satisfaction ».

Mr. Dean. — « Satisfaction » means that your are satisfied. « Complete satisfaction » means that your successor will be also.

Mr. Cividalli (in French). — The French and Belgian Railways maintain that this method is completely satisfactory as far as they are concerned; Mr. LEMMERHOLD was not completely convinced, which was why I added « appears ».

Mr. Jacops (in French). — When a pupil at school is said to be satisfactory, it does not mean he is a genius.

Mr. Carpentier (in French). — If certain conditions cannot be fulfilled, it is not essential to say « complete satisfaction ». Personally I agree.

The President. — Has Mr. LEMMERHOLD anything to say about this question?

Mr. Lemmerhold. — In Germany, we have good results with this protection, but it is not so in all cases.

Mr. Jacops. — Everybody seems to agree we shall suppress the word « complete ».

Mr. Carpentier (in French). — We might add « if properly carried out. »

Mr. Dehaen (in French). — Things which are completely satisfactory are very rare.

I suggest we say : « which give satisfaction ». The method gives satisfaction on the S.N.C.F. and the S.N.C.B.

Mr. Cividalli (in French). — Should we not — I am just asking, not making a suggestion — suppress the word « appear »?

Mr. Lemmerhold. — I agree.

Mr. Jacops (in French). — Under these conditions, if our British colleagues agree, we will say « which gives satisfaction »? (*Agreed.*)

— *The text adopted reads as follows :*

« 9. Methods of protecting metal structures other than painting (metallisation, cathodic protection, use of rustless steel and other metals or alloys) have only been used in special cases.

« Encasing in concrete metal parts exposed to the smoke from locomotives is the current practice on certain Railways; in particular mention must be made of the use of prefabricated concrete or asbestos cement components, which are giving satisfaction. »

Mr. Jacops. — *Summary No. 10 :*

10. Metal bridges are repaired either by replacing damaged parts when possible, or

by reinforcing these elements by adding new profiles or sheets by riveting, bolting or welding. In cases like this, the advisability of using welding is still queried.

Mr. Glendinning. — I would just like to question the translation. « New profiles or sheets » in the English should be « new plates or sections ». Do the English delegates agree to that alteration? (*Agreed.*)

Mr. Portmann (in French). — Mr. PRESIDENT the last sentence seems to me rather vague; would it not be better to have a rather more definite summary as far as welding is concerned?

For example, we might say : « Welding is a practical method which greatly facilitates the work of strengthening structures, but must be used with circumspection, especially on puddled iron ».

Mr. Jacops (in French). — Is the text you have suggested to replace the last sentence of the Summary?

Mr. Cividalli (in French). — I agree with Mr. PORTMANN's suggestion, but must however point out that this was not what emerged from the replies received from the Administrations. The S.N.C.B. for example has never used welding to strengthen steel bridges. The Danish Railways are very cautious about using welding to strengthen old bridges, and in Italy we are even more cautious.

The Netherlands Railways told us that the results of welding are not bad but that welded joints subjected to fatigue did not stand up to it.

In my opinion, the replies which we received do not justify arriving at

any conclusion like that proposed by Mr. PORTMANN.

Mr. Lemmerhold. — In the answers to the questionnaire from 16 English speaking Railway Administrations, 8 have not used welding and they have forbidden it sometimes, but others, as American and Japanese Railways are very satisfied with this welding and also in our country it is used also on wrought iron and with good results, but it is the condition in this case that the material should be suitable and careful execution of the welding is quite necessary, and therefore I suggest the proposal of Mr. PORTMANN be supported and it can be said that some results are the proof of it that welding is a good thing for strengthening.

The President (in French). — In Spain, we also use it with success. It has to be done very carefully.

Mr. Jacops (in French). — Mr. LEMMERHOLD states that 8 Administrations have forbidden it.

Mr. Lemmerhold. — Yes, but there are large Administrations who do this, 8 have forbidden it, but there are 16 altogether.

Mr. Carpentier (in French). — I am in complete agreement with Mr. PORTMANN's suggestion.

If I may be permitted to speak, it is because the S.N.C.F. has gone so far ahead, from the point of view of welded repairs, that Mr. CIVIDALLI's report shows

that the French position diverges from that of certain other Administrations.

I would like to report that the S.N.C.F. has strengthened many bridges in this way, especially after the war; the results have been satisfactory, though we would like to call attention to difficulties which arise in doing it.

A weld which is not carried out with all the necessary precautions, without the circumspection mentioned by Mr. PORTMANN, will inevitably, especially in the case of puddled iron, be a failure.

I would like to know if the Administrations who have used welding have done so on a sufficiently large scale to have the necessary experience. The first trials on the S.N.C.F. date back to 1932; at the beginning, they came up against not failures but localised difficulties; it was these difficulties which enabled us to arrive at the second stage which led us to ask whether welding was not the cheapest way of strengthening bridges — even in the case of puddled iron.

I have some photographs which I can circulate after the meeting to those interested in the subject; these show the very complicated cases to which a satisfactory solution has been found.

Mr. President, I support Mr. PORTMANN's statement.

Mr. Cividalli (in French). — I think the summary might be modified as follows :

« In cases of this kind, the use of welding is still a subject of discussion, *but many Administrations think...* » and here Mr. PORTMANN's suggestion will be added.

Mr. Carpentier (in French). — The use of welding *being* subject to discussion, *certain* Administrations... »

Mr. Jacops (in French). — Discussion between whom?

Mr. Carpentier (in French). — In France, it is not under discussion.

Mr. Dehaen (in French). — It is subject to discussion between us. I support Mr. CIVIDALLI's suggestion.

Mr. Cividalli (in French). — I think it is the only solution — not to come to conclusions.

Mr. Dean. — « And they carry out work accordingly ». That is the crux of the matter. The people who think it is all right they do it. I think that is significant. It is not just an academic question, some Administrations practice it.

Mr. Jacops (in French). — The last sentence will therefore read : « A number of Administrations consider that welding is a practical procedure which facilitates the work of strengthening structures. It must however, be used with great care, particularly with wrought iron. »

The President (in French). — Does everyone agree to this wording? (*Agreed*).

— *The text adopted is as follows :*

« 10. Metal bridges are repaired either by replacing damaged parts when possible, or by reinforcing these elements by adding new sections or plates by riveting, bolting or welding. In cases like this,

the advisability of using welding is still queried.

« A number of Administrations consider that welding is a practical procedure, which facilitates the work of strengthening structures. It must, however, be used with great care, particularly with wrought iron. »

Mr. Jacops. — *Summary No. 11 :*

11. The all over reinforcement of metal bridges can be obtained by adding new elements, or by strengthening the sections of existing elements or their assemblies.

The majority of Administrations prefer to renew bridges completely rather than carry out large scale reinforcing operations, especially in the case of old iron bridges.

In the case of steel bridges, the choice between building a new bridge and reinforcing an existing bridge must be settled by comparing the cost of the different possible types, including the supplementary or indirect costs, and a conservative estimate of the life of the reinforced bridge, together with the expected maintenance costs, which are generally higher in the case of a reinforced bridge than a new bridge.

Mr. Glendinning. — As a matter of translation would the English speaking delegates agree that the word « strengthened » was better than « reinforced »? (*Agreed.*)

Mr. Dunton. — Some of the words in the English translation are not quite the ones which we would use.

Mr. Jacops. — This afternoon, we will settle these questions of translation.

— *The French text of Summary No. 11 was adopted without modification.*

Mr. Jacops. — *Summary No. 12 :*

12. The construction of masonry and concrete arched bridges must be avoided when it does not appear possible to keep the pressure on the soil within limits compatible with a wide margin of safety.

The success of reinforced concrete bridges depends upon using good quality aggregates with suitable granular structure. The water content should not be too high. The arrangement of the reinforcement metal must be carefully studied and executed, and it must be properly covered.

The President. — I do not think this text calls for any comment; it is an elementary truth.

Mr. Dean. — Is there any point in Summary No. 12 at all? It is only telling us to design our bridges well according to the circumstances, and we all know that apart from saying it here.

The President. — Has no one else anything to say?

— *Adopted without modification.*

Mr. Jacops. — *Summary No. 13 :*

13. The condition of masonry and concrete bridges is generally checked by a visual inspection, noting any possible displacement of the reference marks, inspecting test pieces, periodically checking the levels, sounding the surface with a hammer; other special non-destructive methods have been given trials, but none of them appear to furnish any certain information concerning the condition of the bridges deep down.

Mr. Carpentier (in French). — It says in the last paragraph that « other special non-destructive methods of examination have been tested, but none of them appears

to give precise information concerning the inner state of the bridges. »

I consider the word « none » is too extreme; it would be better to say : « ... *but it is difficult and often costly to find accurate data on the internal condition of the bridges.* »

This is shown in particular by the results of investigations carried out on a bridge with a span of 88 metres submitted to the A.I.P.C. Congress at Lisbon : the measures of internal deformations of the bridge and those of deformations on test pieces beside the bridge were of remarkable coincidence; it would therefore appear to be going too far to state that no method has given satisfaction.

Mr. Jacops (in French). — Mr. CARPENTIER's suggestion is therefore as follows : to replace the final part of the last sentence of the summary by the following words : « other special non-destructive methods have been given trials, but it is difficult and often expensive to get accurate information about the inner state of the bridges »

The President (in French). — Do you agree to this wording? (*Agreed.*)

— *Summary No. 13 is adopted with the following text :*

« 13. The condition of masonry and concrete bridges is generally checked by a visual inspection, noting any possible displacement of the reference marks, inspecting test pieces, periodically checking the levels, sounding the surface with a hammer; other special non-destructive methods have been given trials, but it is

difficult and often expensive to get accurate information about the inner state of the bridges. »

Mr. Jacobs — Summary No. 14 :

14. Good conservation of masonry and concrete bridges is only possible if they are sufficiently watertight and have effective drainage systems. These conditions appear to be realised without difficulty in the case of bridges made of longitudinally and transversally prestressed concrete, as well as bridges on which the track is laid directly on the concrete without ballast, where the water quickly drains away. Apart from these special cases a waterproof casing is to be recommended.

Cement mortar casings can give good results when the structures they protect are sufficiently rigid; but in general flexible casings are preferred, made of asphalt or consisting of several layers of material or cardboard impregnated with bitumastic materials, or even metal sheets (generally copper) or plastic materials.

In view of the importance of the casings for the proper conservation of the bridges and the difficulties encountered in renewing them, it is necessary to try and get casings which will last as long as the bridges they protect. In this connection, the recent introduction of plastic materials has to date given satisfactory results. It is possible to hope that the use of thermo-plastic materials will make it possible to obtain this result, provided the casing itself is suitably protected against damage of a mechanical nature.

For this purpose, the use of a protective coat, generally of concrete or asphalt putty is to be recommended.

Mr. Glendinning. — I suggest the English translation should read « preservation » and not « conservation ». « Good preservation of masonry » and so on. (Agreed.)

The President (in French). — It would appear difficult to mention special cases;

I think we should keep to a general summary.

Mr. Dehaen (in French). — Mr. PRESIDENT, the text would appear to state that protective coverings should not be used on prestressed concrete bridges; at first, this was the opinion held by the S.N.C.B., but since then, in view of the danger of the cables corroding, especially the high tension cables, we always stipulate the use of protective coverings.

Mr. Carpentier (in French). — Mr. PRESIDENT, I would like to see the words « *without difficulty* » in the second sentence of the first paragraph deleted, and make this sentence read as follows : « These conditions appear to be *more easily* realised in bridges... » This would seem to me to be more in line with actual practice.

However, I think it is dangerous to let it be thought that there is no need for protective coverings on prestressed concrete bridges; very little experience is as yet available concerning the life of such bridges, and it is known that high tension cables corrode very quickly.

Mr. Dehaen (in French). — That is why we use protective coverings.

Mr. Cividalli (in French). — Is it obligatory?

Mr. Dehaen (in French). — It was the Ministry of Public Works who came to this decision.

Mr. Dean. — The wires are not always highly stressed. It is a technical point

and I would think it wants to be left quite open for there are differences of views and there is no complete agreement that they must be waterproof. I would agree with Mr. CARPENTIER's suggestion « waterproofing is more easily realised ».

Mr. Dehaen (in French). — It is not because the concrete stands up well to compression that it is waterproof. In the case of beams made of prestressed concrete without anchorage where the cable is not protected, it can be attacked by corrosion just like in any other reinforced concrete bridge.

Mr. Dean. — You might perhaps cover it by saying at the end that it « may be desirable in some circumstances to provide waterproofing layers » at the end of the first paragraph.

Mr. Glendinning. — « Waterproof covering. »

Mr. Dean. — It is really « These conditions appear to be realised more easily in the case of bridges made of longitudinally and transversally pre-stressed concrete », and then add « although it may be desirable to add waterproofing in these cases also, in certain circumstances. » I would not like it to be more general than that. Although I think it better to be put in at the end, after the word « recommended ». That sentence will have to be modified to take into account this new point, something on the lines of « In some of these cases as well as for most other constructions, a waterproof casing is to be recommended ».

Mr. Cividalli (in French). — I suggest saying : « Although such conditions appear realisable more easily in the case of bridges of longitudinally and transversely prestressed concrete, as well as in bridges where the track is laid directly on the concrete without ballast and where the rapid draining away of water is assured, *in some of these cases, as well as in most other cases, a waterproof covering is recommended.* »

Mr. Carpentier (in French). — In the following paragraph it is stated — this is a point concerning the wording — « Cement mortar coverings can ... » then « but in general flexible casings in asphalt or composition are preferred... » As far as we are concerned, *flexible* coverings and *asphalt* coverings are two opposite things.

In France, we call *flexible coverings* prefabricated coverings, with an internal reinforcement, but not made on site; we have flexible coverings *or* asphalt coverings.

Mr. Jacops (in French). — The word « flexible » should therefore be left out.

Mr. Carpentier (in French). — Further on it says : « ... or made of several layers of material or cardboard impregnated with bitumastic materials, or even metal sheets (generally copper) or of plastic materials. »

I would have preferred to say : « ... cardboard impregnated with bitumastic materials or even metal sheets *or better still glass fibre* ».

Mr. Cividalli (in French). — We included glass fibre under material.

Mr. Carpentier (in French). — Attention should be called to it. It is said « ... layers of material or cardboard or even metal sheets (generally copper) or of plastic materials ». I would like glass fibre to be mentioned.

Mr. A. Dean makes a few remarks about the translation.

Mr. Jacops (in French). — Summary No. 14 will therefore read as follows :

« 14. Good preservation of masonry and concrete bridges is only possible if they are sufficiently watertight and have effective drainage systems.

« Although it appears easier to realise these conditions in cases of bridges constructed in longitudinally and transversely pre-stressed concrete, as well as bridges on which the track is laid directly on the concrete without ballast, and where the water quickly drains away, in certain of these cases, as well as in the majority of other cases the use of a waterproof covering is recommended.

« Cement mortar casings can give good results when the structures they protect are sufficiently rigid. In general, coverings are preferred, made of asphalt or consisting of several layers of material or fibre, or better still glass fibre impregnated with bitumastic materials, and even metal sheets (generally copper) or sheets of plastic materials.

« In view of the importance of the casings for the proper conservation of the bridges and the difficulties encountered in renewing them, it is necessary to try and get casings which will last as long as the bridges they protect. In this connection, the recent introduction of

plastic materials has to date given satisfactory results. It is to be hoped that the use of thermo-plastic materials will make it possible to obtain this result, provided the casing itself is suitably protected against damage of a mechanical nature.

« For this purpose, the use of a protective coat, generally of concrete or mastic asphalt is to be recommended. »

The President (in French). — Do you approve the summary worded in this way? (*Agreed*).

Mr. Jacops. — *Summary No. 15 :*

15. If the masonry or concrete bridge is threatened with deterioration due to a lack of watertightness and when operating reasons prevent the carrying out of repairs to the casing, waterproofing processes may be used applied to the soffits or through them, making it possible to reduce permeability effectively or even doing away with the drains altogether.

— *Adopted without comment.*

Mr. Jacops. — *Summary No. 16 :*

16. Heavier loads and higher speeds can be allowed over old masonry bridges than those provided for when they were designed, provided a very careful check is made of the condition of the bridge; calculations for verifying the strength are not generally considered necessary.

Carrying out work to reinforce masonry bridges with the sole object of allowing heavy loads over them is consequently in practice exceptional.

Mr. Dean. — I would rather see the word « exceptional » changed to « unusual ». We do it quite a bit.

Mr. Carpentier. — **MR. PRESIDENT**, I would like it to be stated at the end of

the first paragraph... « calculations for verifying the strength are not *always* considered necessary » instead of « are not *generally* considered necessary ».

Mr. Cividalli (in French). — Nearly all the Administrations replied that they did not make them.

Mr. Jacops (in French). — You wish to retain « generally » ?

Does the meeting agree to Mr. DEAN's suggestion to replace the words « *exceptional* » at the end of the summary by « *unusual* » ?

Mr. Dehaen (in French). — Obviously, it is not possible to allow the load to be increased indefinitely. I suggest therefore we say : « ... the passage of heavier loads to a *certain extent* ... ».

Mr. R. Lévi (in French). — This never varies very much.

It is difficult to give a text of this sort. It is not possible to lay down the margin within which no checks are necessary.

Mr. Jacops (in French). — Could we not say at the beginning of this summary : « *To a certain extent* in the case of old masonry bridges... » ?

Mr. R. Lévi (in French). — To what extent ?

The President (in French). — Has Mr. DEHAEN any suggestion to make ? (*No*).

Under these conditions, the text will

be retained as it is, except for the final sentence :

« Carrying out work to strengthen masonry bridges with the sole object of allowing heavier loads over them is consequently in practice *unusual*. » (*Adopted.*)

— *The text of Summary No. 16 thus becomes :*

« 16. Heavier loads and higher speeds can be allowed over old masonry bridges than those provided for when they were designed, provided a very careful check is made of the condition of the bridge; calculations for verifying the strength are not generally considered necessary.

« Carrying out work to strengthen masonry bridges with the sole object of allowing heavy loads over them is consequently in practice *unusual*. »

Mr. Jacops. — *Summary No. 17 :*

17. The work or repairing or strengthening the arches involves special precautions to avoid abnormal distribution of the stresses (anchoring irons, seams, jaggings, centering).

Partial remaking of the arches is advantageous if it only affects a relatively restricted portion of the bridge and if the condition of the remainder of the arch, abutments and foundations is such that a long useful life can be expected from the repaired bridge.

Mr. Glendinning. — There appears to be a mis-translation, I think, at the end of the first paragraph. It should read, « anchoring irons, ribs, lagging, centering ». Do the English delegates agree ? (*Agreed.*)

— *The French text is adopted without modification.*

Mr. Jacops. — *Summary No. 18 :*

18. The organisation of the inspection and maintenance of bridges varies according to local circumstances; it is not possible to establish any general rules concerning the most rational maintenance methods for bridges.

Where the roads are adequate so that it is easy to get to the place of work by road, it is not advantageous for the railway to do the work itself, unless there is only a small amount of work to be done.

The geographical position and operating conditions on the railways may, on the other hand, alter the position and make it advantageous to carry out work of greater importance, or even oblige the railway to do all its own maintenance work without distinction.

Mr. Dean. — I would prefer instead of the words « is not » in the third line of the second paragraph to read « may not be ». That is « it may not be advantageous for the railway to do the work itself ... ». Then, in the third paragraph the words « alter the position and ». This paragraph would then read : « The geographical position and operating conditions on the railways may, on the other hand, make it advantageous to carry out work of greater importance, etc... ».

Mr. Glendinning. — You suggest that « alter the position » in the English text is redundant ?

Mr. Dean. — Yes, that it is. (*Agreed.*)

Mr. Unal, Secretary (in French). — In the second paragraph it will therefore be necessary to say : « ... the carrying out of the work by the company itself may not be profitable... ».

Mr. Carpentier (in French). — Yes : « ... or is not ... ».

Mr. Unal. — « ... may not be profitable ... » and delete the « or ». This would meet Mr. DEAN's wishes.

Mr. Jacops (in French). — So that we would say : « ... is only advantageous when there is a small amount of work ... ».

« The geographical position and operating conditions of the railways ... ».

Mr. Cividalli (in French). — It is a question of necessity; there are no other possibilities.

Mr. Jacops (in French). — In English, there is duplication which does not occur in the French text : « ... and the operating conditions on the railways may, on the other hand, ... » but if no one has any objection to raise, I think we can pass it over.

Consequently, only the second paragraph will be altered :

« Where the roads are adequate so that it is easy to get to the place of work by road, *it may not be advantageous* for the railway to do the work itself, unless there is only a small amount of work to be done. »

— *The text adopted for Summary No. 18 is as follows :*

« 18. The organisation of the inspection and maintenance of bridges varies according to local circumstances; it is not possible to establish any general rules concerning the most rational maintenance methods for bridges.

« Where the roads are adequate so that it is easy to get to the place of work by road, it may not be advantageous for the railway to do the work itself, unless there is only a small amount of work to be done.

« The geographical position and operating conditions on the railway may, on the other hand, make it advantageous to carry out work of greater importance, or even oblige the railway to do all its own maintenance work without distinction. »

Mr. Jacops. — *Summary No. 19 :*

19. Those Administrations who themselves carry out maintenance work of some importance have specialised gangs, generally used exclusively on the maintenance of metal bridges.

— *Adopted without comment.*

Mr. Jacops. — *Summary No. 20 :*

20. The materials needed for the repairs carried out by the bridge gangs are generally supplied from the stocks, stores or depots of the Administrations, whereas those needed for work carried out by contractors are supplied by the latter.

Several Administrations, however, prefer to supply in all cases the paint needed to repaint metal bridges.

— *Also adopted without comment.*

The President (in French). — Gentlemen, this brings us to the end of our work in connection with Question I.

The Wording Committee we set up will meet to-morrow morning to amend certain texts as decided by you.

— The meeting adjourned at 1 p.m.

Meeting of the 1st October 1958.

PRESIDENT : F. PEREZ VILLAMIL.

— The meeting opened at 9.30 a.m.

The President (in French). — Gentlemen, if you are agreeable, we will now get on with our work.

This morning the Meeting has to decide the final text of Summaries Nos. 5 and 6 as revised to take into account the suggestions made at our first meeting by various Delegates.

Here is the original text of Summary No. 5 :

« 5. Good conservation of metal bridges necessitates above all protection against corrosion, which occurs especially

at those points which are difficult of access, exposed to dirt, insufficiently ventilated, or likely to collect water.

« Consequently, when designing new bridges it is essential to select smooth, simple designs, and adequate constructional arrangements; in addition bridges should be maintained regularly. »

Mr. Jacops (in French). — You will remember, Gentlemen, that Mr. Robert LÉVI pointed out that the suggestion made by Mr. PORTMANN, when discussing Summary No. 3, should be taken into account in Summary No. 5.

It is a question of fatigue, which is still insufficiently known or understood perhaps.

Mr. IVANOVIĆ of the Yugoslavian Railways then suggested inserting the following sentence in this summary: It is desirable whenever possible to use welding.

In fact, the Meeting was not unanimous at all in recommending welding, although approving of its use in certain cases.

This addition was proposed by Mr. IVANOVIĆ as a recommendation.

Mr. Robert LÉVI considered that this might, in certain cases, lead to preference being given to welding rather than riveting.

Mr. PORTMANN's suggestion was retained in principle and the proposed text should be included in Summary No. 5 and not in Summary No. 3.

Under these conditions, we might reword Summary No. 5, using to begin with Mr. PORTMANN's suggestion.

I would remind you that Mr. CIVIDALLI, the *Special Reporter*, pointed out that there was a relatively long enumeration of the causes of deterioration in his report, and that it was not advisable to include these again in the text of the summaries. We think, however, that such an enumeration might be made sufficiently brief to be included in a summary.

Would Mr. CIVIDALLI please enumerate these causes of deterioration?

Mr. Cividalli (in French). — To begin with I think it must be pointed out that the opinions of the different Administrations diverge concerning the deterioration due to fatigue. Certain Adminis-

trations consider that such deterioration cannot be discovered, whilst others consider that the ageing of the material due to fatigue is a fact.

Mr. Jacops (in French). — We were agreed, Mr. CIVIDALLI, to mention those causes of deterioration on which opinions are unanimous.

Mr. Cividalli (in French). — No doubt, but it must be first of all stated that: « Whilst the opinions of the Administrations differ concerning deterioration due to fatigue, all agreed that generally the damage observed can be attributed to several causes ... »

In case of a derailment, for example, there is only one reason for the deterioration, but generally there has been a first reason to which nearly always corrosion must be added. Deterioration due to corrosion is never or hardly ever the first cause: that is a constructional defect...

Mr. Jacops (in French). — Do you agree in principle, Gentlemen?

Mr. Cividalli (in French). — Everyone agrees on the fact that rust is the great enemy of metallic construction.

Mr. Jacops (in French). — Do you wish to begin the summary by stating that opinions differ regarding fatigue?

Mr. Cividalli (in French). — I think it necessary to say so.

Mr. Jacops (in French). — It seems to me, Mr. CIVIDALLI, that you more or

less have a text in mind already, so would you be kind enough to make it known to us ?

Mr. Cividalli (in French). — « Whereas the opinions of the Administrations differ concerning deterioration due to fatigue, the causes thereof most generally recognised are... » Several Administrations have also reported damage due to derailments.

Mr. Jacops (in French). — We have agreed, but all the same...

Mr. Cividalli (in French). — Would you prefer to say : « Generally, the damage observed must be attributed to several causes... » or again : « ... to a combination of several causes. »

Mr. Jacops (in French). — Some of them must be mentioned.

Mr. Cividalli (in French). — Defects in design, constructional defects, exceptionally defects in the materials used, and above all corrosion.

The President (in French). — Is there anything to add, Mr. PORTMANN ?

Mr. Portmann (in French). — No, Mr. PRESIDENT, I said that the most important cause of deterioration was corrosion...

Mr. Jacops (in French). — ... Due to moisture.

Mr. Unal (in French). — And lack of maintenance, Mr. CARPENTIER ?

Mr. Jacops (in French). — Here is the text I jotted down :

« While the opinions of the Administrations differ concerning deterioration due to fatigue, it is generally recognised that the damage observed must be attributed to a combination of several causes, mistakes in design or construction, and above all corrosion. »

Mr. Legrand, *French National Railways* (in French). — I think it would be better to say : « While the opinions of the Administrations differ regarding the *influence* of fatigue... »

Mr. Unal (in French). — « ... defects in design or construction, *exceptionally defects in the materials*, and above all corrosion. » ?

Mr. Cividalli (in French). — It is no longer mentioned, but lack of maintenance might well be included.

Mr. Unal (in French). — « ... insufficient maintenance... » ?

Mr. Jacops (in French). — Could we not say : « corrosion due to lack of maintenance » ?

Mr. Carpentier (in French). — No.

Mr. Jacops (in French). — Are we going to keep : « lack of maintenance » ?

Mr. Carpentier (in French). — No, because this depends essentially on the elements considered; there are some which are very little affected by corrosion.

Mr. Jacops (in French). — Consequently : « ... and above all corrosion. »

Mr. Cividalli (in French). — We might say : « In the case of metal bridges, it is important above all... »

Mr. Jacops (in French). — We will go back to the original text of the summary : « Good preservation of metal bridges necessitates above all protection against corrosion, which occurs... » or : « ... against corrosion. *This latter occurs in particular at those points which are difficult of access, exposed to dirt or smoke, insufficiently ventilated or likely to collect water.* »

« Consequently, when designing new bridges it is essential to select smooth, simple designs, and adequate constructional arrangements; in addition bridges should be maintained regularly. »

Consequently mention is made of maintenance.

Mr. Cividalli (in French). — Here, **Mr. IVANOVIC's** suggestion must be taken into account.

Mr. Jacops (in French). — « Whenever possible, welding should be used rather than rivetting. »

Mr. Unal (in French). — **Mr. IVANOVIC** asked that construction by welding should be recommended and not riveting.

The President (in French). — Mention must be made of the consequences such a statement may have in certain cases. Moreover, it was **Mr. DEAN** who made the remark and **Mr. IVANOVIC** agreed with him.

Mr. Unal (in French). — This part of the sentence should come after : « ... adequate constructional arrangements; *this consideration may lead in certain cases to welding being preferred to rivetting.* »

Mr. Carpentier (in French). — Would it not be better to say *welded constructions* rather than riveted in order to mean the forms.

The President (in French). — Would **Mr. JACOBS** be good enough to read the whole of the summary ?

Mr. Jacops. — « While the opinions of the Administrations varied concerning the influence of fatigue, it was generally recognised that the observed deterioration can be said to be due to a number of causes, faulty design or construction, and above all corrosion. For good preservation of metal bridges it is of primary importance to protect them against the latter, which is most likely to occur at those places which are difficult of access, exposed to dirt or smoke, insufficiently ventilated, or likely to collect water.

« Consequently, when designing new bridges, it is essential to select smooth, simple designs, and adequate constructional arrangements. This consideration can lead in certain cases to preference being given to welded construction rather than rivetted construction. In addition, bridges should be given regular maintenance. »

Mr. Dunton. — I don't like the word « fatigue » in the first sentence and I believe if the word « fatigue » could be altered it would be easier for us to agree.

Fatigue in English is a process in metal, an ageing in the metal, fracture and so forth. I think the word here should be « deterioration » not « fatigue ».

Mr. Jacops. — « Ageing », here we think of the age.

Mr. Dunton. — Surely, we are talking about the preservation of bridges to ensure a long life, and these are the causes which would prevent long life and shorten the life of a bridge, causes such as corrosion and bad design. All these causes could shorten the life of a bridge by bringing us to a point of having to renew, and yet it would be a point whether fatigue would be the reason for renewal. I think the word « fatigue » in the English translation is a mistake.

Mr. Jacops. — I think it is possible : rapid ageing of bridges. Let us say rapid ageing of bridges, and we mention that the opinions differ.

Mr. Dunton. — As to the reason for premature ageing.

Mr. Jacops. — So we can write « premature ageing ». This is all right. Now we have the intervention of Mr. IVANOVIĆ « deterioration could lead to welded structures being preferred to riveted structures ». Then, we come back to the original translation. « In addition bridges should be maintained regularly. »

Mr. Glendinning. — Is the word « smooth » all right ?

Mr. Dean and Mr. Dunton. — Yes.

Mr. Carpentier (in French). — I do not know if the translation Mr. DUNTON is asking for corresponds with the idea we have in mind. Mr. DUNTON is concentrating more or less completely on the ageing of bridges, the ageing of the metal due in particular to fatigue, whilst we are thinking of the consequences of fatigue. To speak of ageing alone seems to me to restrict the consequences of fatigue and not to see the problem as a whole.

Mr. Dean. — And another consequence of fatigue is fracture, but we do not wait until there is a fracture before we renew bridges. We renew bridges because there is evidence arising from faulty design or that corrosion is getting the better of the structure.

Mr. Dunton. — Fatigue in the English text means metal fatigue.

Mr. Dean. — Yes, it is irrelevant in this case.

Mr. Jacops. — In speaking of fatigue, you are also thinking of the resulting brittleness ?

Mr. Carpentier (in French). — In welded construction, for example, it is not a question of the ageing, but the effects of fatigue which starts from a hair crack for example; this is not ageing in any way, but it may lead to the destruction of the bridge.

Mr. Dunton. — Can I ask Mr. CARPENTIER whether his bridges are renewed because of metal fatigue ?

Mr. Carpentier (in French). — I do not wish to answer this question which is in fact under discussion at the present time with my colleagues; we want to know what part fatigue plays in the renewal of bridges; as far as I am concerned, I am not sure exactly what it is.

Mr. Jacobs translates this into English and adds: In the meantime, we need a word and the French delegate wants « fatigue » to be taken in its widest meaning.

Mr. Dunton. — It is a word we need.

Mr. Lemmerhold. — I have the same opinion as the British Railways. In Germany, the expression « fatigue » is only used for the circumstances that the resistance of a metal will be lower, if the construction is under load, changing or growing, and not only static (Wöhler line). It has nothing to do with ageing. That is quite another thing. In can be that a bridge is used more than 100 years without any appearance of fatigue. I think we should speak here only of the ageing of bridges.

Mr. Carpentier (in French). — I willingly agree with the formula which consists in suppressing the word « fatigue » amongst causes of deterioration, in the first sentence of the summary; fatigue due for example to the ageing of the steel. We are not at all in agreement on this point.

Mr. Cividalli (in French). — Do you call fatigue simply ageing? You don't consider the reversing of the stresses as fatigue?

Mr. Lemmerhold. — « Fatigue » that is the expression in Germany.

Mr. Carpentier (in French). — Taking it that the phenomenon of fatigue does exist in bridges and that a structure has not been designed with such fatigue in mind, that there was no reduction in the stresses, you will have a lower margin of safety, and consequently damage will occur in it quicker than in the others. Consequently, fatigue, in the real sense of the word, will have been the cause of the damage.

Mr. Lemmerhold (in German). — If the design of the bridge is such that the normal limit laid down by Wöhler's law is exceeded unwittingly, this is a defect in the design.

Mr. Dehaen (in French). — Could we not mention the two causes: fatigue and ageing?

Mr. Rolph, East African Railways and Harbours. — Can I say that the word « fatigue » is, in fact, borrowed by the English from the French. It is not basically an English word and it has a very specialised application in engineering terminology. I would suggest therefore that although the word may be perfectly applicable in the French version, a more appropriate word or phrase be used in the English text.

Mr. Dunton. — I think we would agree with fatigue or premature ageing, but we are dealing here with reasons by which bridges have to be renewed sooner than we would anticipate and when we speak of lengthening the life of a bridge we have to consider not only fatigue which, in

English, is an effect in the metal, but we have to consider other forms of deterioration, such as loss of section.

Mr. Jacops. — But corrosion, we speak of it. We say simply everybody does not agree on fatigue.

Mr. Dunton. — Problems of ageing.

Sir Landale Train, British Transport Commission. — I really do not know what all the argument is about, because the question which is being answered does mention fatigue: that is « does fatigue play a part in the necessity for renewing bridges? » I thought that was one of the things we had to answer, and as for the meaning of the word « fatigue » in French and English, I think we have got to mention fatigue because it does play a part in the renewing of bridges, and I suggest it is up to you to mention, « yes, it does play a part » or « no, it does not play a part ».

Mr. Jacops (in French). — The English Delegates therefore propose saying: the problems of ageing.

Mr. Cividalli (in French). — It is not fatigue.

Mr. Jacops (in French). — Naturally, I am not altering the French text; we are trying to find a reasonable English equivalent. In French, we would say: « ... the influence of fatigue and ageing... » (*Then continuing in English.*)

The Special Reporter has said that there is a divergence of views about the problems of ageing, so it is perhaps better not to insist on those problems; he said that the problem is not resolved.

It is perhaps a question that can be discussed again at the next Congress when everybody will have a firmer view on the things than we have now. **Mr. Cividalli** did not say in his text that fatigue is a cause, but he said that the opinions are not the same; so it is difficult in a conclusion to say something real about the problem.

Sir Landale Train. — Yes that is recognised, opinions differ.

Mr. Jacops. — And he only wishes to mention that opinions differ.

Sir Landale Train. — Yes, that is so.

Mr. Jacops. — It is, everybody agrees, a question of getting the proper word. I think **Mr. Dunton** is right when he says « the problem of ageing ».

Mr. Dean. — Including fatigue. I think we should say: « problems of ageing, including fatigue ». It then makes the answer adequate. It is a fact of experience that we have all had to renew a small number of bridges because of fatigue, but generally the renewal arises from other causes which have played their part, poor initial design, corrosion, etc. We have all had experience which we could place to no other door than that of fatigue. It is not the first thing which arises, but is a consequence of other causes. If there is evidence of fatigue generally, we don't have evidence of it locally. It is appropriate we should mention it as a cause of ageing, taking into account corrosion, deterioration, and all other causes. It goes with them in practical experience.

Mr. Jacops (in French). — Gentlemen, I think that in the case of the French text we should stick to the wording suggested by Mr. DEHAEN : fatigue and ageing.

On the other hand, if I may be permitted to express an opinion on the English text, I think the word *ageing* is perfectly comprehensible without adding any explanations.

Do you agree ?

I think what we had better do is make the translation officers responsible for finding the correct English text.

Mr. Cividalli (in French). — Will Mr. JACOBS please read us the French text as finally amended.

Mr. Jacops. — Here is the whole text :

« 5. While the opinions of the Administrations varied concerning the influence of fatigue and ageing, it was generally recognised that the observed deterioration can be said to be due to a number of causes, faulty design or construction, and above all corrosion. For good preservation of metal bridges it is of primary importance to protect them against the latter, which is most likely to occur at those places which are difficult of access, exposed to dirt or smoke, insufficiently ventilated, or likely to collect water.

« Consequently, when designing new bridges, it is essential to select smooth, simple designs, and adequate construction arrangements. This consideration can lead in certain cases to preference being given to welded construction rather than rivetted construction. In addition, bridges should be given regular maintenance. »

The President. — I think that all the Delegates present are agreeing about this wording ? (*Agreed.*)

— *The text just read is adopted.*

The President (in French). — We will now go on to Summary No. 6. Here is the old wording :

« 6. Careful painting and regular repainting, carried out after proper preparation of the surfaces (hammering, scraping with metal brushes, in difficult cases descaling by sand jet and sometimes burning off) are the most currently used methods for protecting metal bridges against corrosion.

« In general, the paint used is the classic red lead, iron or chromate of zinc (undercoats) and white zinc, white lead, iron oxide and aluminium paints, or those with a bitumastic or tar base (protective paints).

« It is not yet possible to formulate any valid opinions concerning the trials made of special paints based on new formulae (with a vinylitic resine base, lead-metal, chlorated rubber, etc.) which some railways have started to use. »

Mr. Jacops (in French). — This summary gave rise to several comments.

Mr. CARPENTIER considered that the words « in difficult cases » should be omitted. It was then agreed that it was merely an enumeration and we did not have to express any opinion on the value or advisability of using such and such a method.

Mr. LOHMANN told us that sand jets were forbidden in the Netherlands; it

was answered that if this process was forbidden in one country, we should not necessarily condemn it in the summaries.

There was then a discussion about sand jet, steel particles or shot, fine gravel free from silica.

Mr. DEHAEN mentioned *descaling by flame*, which is a better term than *burning off*; everyone agreed about this suggestion.

Mr. Robert LÉVI raised two points : From the investigation made, does it appear that painting the undercoats in the shops is to be recommended ?

To this first question, Mr. CIVIDALLI replied that the first coat is given in the shops in all cases, the second on site.

The second question asked by Mr. Robert LÉVI concerned bitumastic or tar paints.

According to the original text, such paints were considered solely as protective paints; consequently, the point did not arise.

To sum up, we decided to reword Summary No. 6. In fact, it is the parenthesis in the first paragraph which is causing the most trouble. Can Mr. CIVIDALLI suggest a new text ? He did suggest separating painting and repainting.

Mr. Cividalli (in French). — I do not think that was what I suggested; I simply asked whether such a distinction ought not to be made ?

Mr. Jacops (in French). — But the Meeting agreed!

Mr. Cividalli (in French). — Yes.

Mr. Jacops (in French). — We must therefore find the right wording.

After a lengthy discussion, in which Messrs. R. LÉVI, CARPENTIER, CIVIDALLI and JACOPS took part :

The PRESIDENT concluded : I think the amended version of the first paragraph has been adopted ? (*Agreed.*)

The second paragraph will be worded as follows : « It is recommended to give the first coat of paint in the shops... »

Mr. R. Lévi (in French). — It should be added : « ... *after careful and thorough descaling.* » This is the essential thing, and nothing is being said about it.

Mr. Jacops (in French). — If I understand it aright, we must say : « It is recommended to give the first coat of paint in the shops after *careful* descaling of the surface. »

Mr. Unal (in French). — In the case of new structures ?

Mr. Dean. — The problem is, I think, whilst I support Mr. LÉVI in trying to draw a distinction, once we come back to how protection can be applied in shops we are entering into a different range of techniques, and some additional to those which are already covered by the text. It is not everyone who prepares in the shops. Some take it out on the site and let it weather for 12 months before paint is applied. On the other hand, if parts are going into structures which when erected are going to be very difficult to get at again, the metal may have a spray

application at the shops before going out to the site. We have to decide whether to extend the question, whether to extend the answer to one which is practical and real. It is not just a matter of saying whether when you have descaled and cleaned in the shops where you put the first coat on. That is common sense. But there are other alternatives to be considered. There is not one common practice, it varies according to circumstances very much.

The President (in French). — We cannot take every special case into account.

Mr. Dean. — I might perhaps suggest that the interposition proposed by Mr. LÉVI were simply to read : « For new structures, it is recommended that where the surface has been prepared in the workshop the first coat of paint should be applied immediately thereafter ».

Mr. Jacops (in French). — The wording suggested by Mr. DEAN will therefore be as follows : « *In the case of new structures, it is recommended that when the surface has been prepared in the shops, the first coat of paint shall be applied immediately afterwards.* » This leaves us free to suppose that in certain cases, descaling is not done in the works...

Mr. Carpentier (in French). — This no longer means what Mr. LÉVI said.

Mr. LÉVI wished to specify definitely that the first coat of paint should be applied under optimum conditions, in the shops.

Mr. Dean. — I will accept it is desirable, if the preparation is done in the shop, that

the first coat is done thereafter. I don't accept that the first coat must always be done in the shop.

Mr. Rolph. — Mr. CHAIRMAN, we are dealing with the maintenance of existing bridges and the painting of new bridges does not arise. Such painting is a different problem. I suggest that the painting of new bridges be not discussed.

Mr. Cividalli (in French). — I do not think it is merely a question of old bridges; we are speaking about the ageing of bridges, which covers present and future bridges.

Mr. Jacops (in French). — I think, Gentlemen, that we can accept Mr. LÉVI's suggestion, as after all it is merely a question of recommendations; and there will always be some special cases to deal with.

Mr. Dunton. — Could we insert a word and say « it is recommended generally », or « in most cases ».

Mr. Jacops (in French). — I do not think the last paragraph requires any modification.

Here is the amended text of Summary No. 6 :

« 6. Careful painting and regular repainting, carried out after proper preparation of the surfaces (hammering, scraping with metal brushes, descaling by sand jets or shot blasting, and sometimes flame cleaning) are the most currently used methods for protecting metal bridges against corrosion.

« For new structures, it is generally recommended to apply the first coat of paint in the Workshop after descaling and cleaning.

« In general, the paint used is the classic red lead, iron, or chromate of zinc paint (undercoats) and white zinc, white lead, iron oxide, and aluminium paints, or those with a bitumastic or tar base (protective paints).

« It is not yet possible to formulate any valid opinions concerning the trials made of special paints based on new

formulae (with a vinylitic resine base, lead-metal, chlorated rubber, etc.) which some railways have started to use. »

— *Adopted.*

The President (in French). — Gentlemen, we have now completed the first part of our work.

To-morrow, we will begin to discuss Question 2, which deals with very long rails.

— The meeting ended at 11 a.m.

Meeting of the 2nd October 1958.

PRESIDENT : F. PEREZ VILLAMIL.

— The meeting opened at 9.30 a.m.

The President (in French). — Gentlemen, before we begin to discuss Question 2, I wish to submit for your approval the minutes of our previous meetings which were published in Nos. 2 and 3 of the *Daily Journal of the Congress*.

I will ask Mr. CIVIDALLI, the *Special Reporter* for Question 1, if he has any comments to make ?

Mr. Cividalli (in French). — No, Mr. President.

Mr. Carpentier (in French). — Mr. PRESIDENT, I would like to make a little comment which does not basically affect the question. It refers to Summary No. 14

(French text) which is worded as follows : « ... where the water quickly drains away. Apart from these special cases a waterproof casing is recommended. »

I would prefer the end of this paragraph to read like this : « ... and where the water quickly drains away, in certain of these cases, as well as in the majority of other cases, the use of a waterproof covering is recommended. »

This seems to be more accurate to me.

In the following paragraph, another small modification might be made. I think the sentence is rather long, and suggest the following wording, which does not alter the meaning of the text :

« Cement mortar casings can give good results when the structures they protect

are sufficiently rigid. In general, coverings are preferred made of asphalt or consisting of several layers of material or fibre, *or better still glass fibre* impregnated with bitumastic materials and even metal sheets (generally copper) *or sheets of plastic materials.* »

No changes are needed in any of the other summaries.

The President (in French). — Are you agreed, Gentlemen, about these modifications in the wording ? (*Agreed.*)

— *The final text of Summary No. 14 is given hereafter.*

Mr. Dean. — In the English text, Question 1, Summary No. 1, the wording is rather clumsy and I would suggest we

say, instead of the last paragraph, the following :

« For good modern designs of bridges the influence of probable life on total financial charges is not generally very great, and the choice of a type of structure to be decided upon is determined by more important considerations. »

Then in Summary No. 2 where it says : « which often make it impossible to carry out the maintenance work... » we want to put in the word « *all* » before « the maintenance work ». « ... impossible to carry out all the maintenance work... »

The President (in French). — No other comments, Gentlemen ?

We will therefore go on to Question 2.

— *The complete text of the summaries for Question 1 is given hereafter.*

DISCUSSION AT THE PLENARY SESSION.

Meeting of the 3rd October 1958.

PRESIDENT : Sr. D. AGUSTÍN PLANA.

GENERAL SECRETARIES : MESSRS P. GHILAIN AND J. PÉREZ POZUELO.

The President (in French). — Gentlemen, one item of our agenda is the examination of the summaries which have already been adopted by the various Sections.

Will the General Secretary please be good enough to read us the summaries for Question 1 of the 1st Section.

Mr. Ghilain, *General Secretary*, submitted to the Meeting the summaries for Question 1, which were published in Nos. 2, 3 and 4 of the *Daily Journal of the Congress*.

(The reading of these summaries did not give rise to any comments.)

The President (in French). — We can therefore consider the summaries for Question 1 as ratified.

SUMMARIES.

« 1. It is not possible to foretell the
« life of a bridge when building it solely
« based on experience acquired from
« observing existing bridges.

« Best quality materials, the most
« careful methods of calculation, and
« new constructional methods lead us to
« think that the life of new metal and

« reinforced concrete bridges will be very
« long, provided they are suitably main-
« tained.

« The influence of probable life of
« a bridge on total financial charges is
« not generally very great, and the choice
« of a type of structure to be decided
« upon is determined by more important
« considerations.

« 2. Several Administrations fix the
« budget allocations for maintenance
« and renewal as a function of the total
« value of the bridges; but most of them
« determine these sums from the condi-
« tion of the bridges and the experience
« acquired, taking into account their
« financial resources, which often make
« it impossible to carry out all the main-
« tenance work which had become
« necessary.

« 3. The progressive increase in the
« loads generally makes it necessary to
« check by calculation existing metal
« bridges in order to decide if they can
« take the new loads proposed.

« The opinions of the Administrations
« differ as to the proper interpretation
« of the technological tests which have
« been carried out on elements from old

« metal bridges. The stress limits allowed for such bridges vary considerably from one Railway to another.

« 4. To examine metal bridges the Administrations generally make use of sounding by hammer in the case of rivetted assemblies, and measuring the deflections and stresses as well as the use of X rays to check the welds. New processes, such as those based on ultrasonic equipment or magnetisation have already been given a trial on several Railways.

« 5. While the opinions of the Administrations varied concerning the influence of fatigue and ageing, it was generally recognised that the observed deterioration can be said to be due to a number of causes, faulty design or construction, and above all corrosion. For good preservation of metal bridges it is of primary importance to protect them against the latter, which is most likely to occur at those places which are difficult of access, exposed to dirt or smoke, insufficiently ventilated, or likely to collect water.

« Consequently, when designing new bridges, it is essential to select smooth, simple designs, and adequate constructional arrangements. This consideration can lead in certain cases to preference being given to welded construction rather than rivetted construction. In addition, bridges should be given regular maintenance.

« 6. Careful painting and regular repainting, carried out after proper preparation of the surfaces (hammering, scraping with metal brushes, descaling

« by sand jets or shot blasting, and sometimes flame cleaning) are the most currently used methods for protecting metal bridges against corrosion.

« For new structures it is generally recommended to apply the first coat of paint in the workshop after descaling and cleaning.

« In general, the paint used is the classic red lead, iron, or chromate of zinc paint (undercoats) and white zinc, white lead, iron oxide, and aluminium paints, or those with a bitumastic or tar base (protective paints).

« It is not yet possible to formulate any valid opinions concerning the trials made of special paints based on new formulae (with a vinylitic resin base, lead-metal, chlorated rubber, etc.) which some railways have started to use.

« 7. In the opinion of most of the Administrations in the case of rivetted structures, surfaces permanently in contact should be protected by a coat of paint.

« In the case of welded structures, on the contrary, this practice may be given up when the surfaces in contact are assembled by continuous welds.

« In addition, it is recommended not to cover these surfaces with paint when high tensile bolts are used for assembly.

« 8. Where local conditions are particularly unfavourable, it is necessary to repaint every two years, whereas intervals of 30 to 40 years between repainting may be possible in certain mountain districts where the air is pure and dry.

« Partial repainting makes it possible
« to increase the intervals between two
« complete overhauls.

« 9. Methods of protecting metal
« structures other than painting (metalli-
« sation, cathodic protection, use of rust-
« less steel and other metals or alloys)
« have only been used in special cases.

« Encasing in concrete metal parts
« exposed to the smoke from loco-
« motives is the current practice on cer-
« tain Railways; in particular mention
« must be made of the use of prefa-
« bricated concrete or asbestos cement
« components, which are giving satis-
« faction.

« 10. Metal bridges are repaired
« either by replacing damaged parts
« when possible, or by reinforcing these
« elements by adding new sections or
« plates by rivetting, bolting or welding.
« In cases like this, the advisability of
« using welding is still queried.

« A number of Administrations con-
« sider that welding is a practical proce-
« dure, which facilitates the work of
« strengthening structures. It must, how-
« ever, be used with great care, parti-
« cularly with wrought iron.

« 11. The all over reinforcement of
« metal bridges can be obtained by
« adding new elements, or by strengthen-
« ing the sections of existing elements
« or their assemblies.

« The majority of Administrations
« prefer to renew bridges completely
« rather than carry out large scale rein-
« forcing operations, especially in the
« case of old iron bridges.

« In the case of steel bridges, the
« choice between building a new bridge
« and reinforcing an existing bridge must
« be settled by comparing the cost of
« the different possible types, including
« the supplementary or indirect costs,
« and a conservative estimate of the life
« of the strengthened bridge, together
« with the expected maintenance costs,
« which are generally higher in the case
« of a strengthened bridge than a new
« bridge.

« 12. The construction of masonry
« and concrete arched bridges must be
« avoided when it does not appear pos-
« sible to keep the pressure on the soil
« within limits compatible with a wide
« margin of safety.

« The success of reinforced concrete
« bridges depends upon using good qua-
« lity aggregates with suitable granular
« structure. The water content should
« not be too high. The arrangement
« of the reinforcement metal must be
« carefully studied and executed, and it
« must be properly covered.

« 13. The condition of masonry and
« concrete bridges is generally checked
« by a visual inspection, noting any pos-
« sible displacement of the reference
« marks, inspecting test pieces, perio-
« dically checking the levels, sounding
« the surface with a hammer; other spe-
« cial non-destructive methods have been
« given trials, but it is difficult and
« often expensive to get accurate infor-
« mation about the inner state of the
« bridges.

« 14. Good preservation of masonry
« and concrete bridges is only possible

« if they are sufficiently watertight and
« have effective drainage systems.

« Although it appears easier to rea-
« lise these conditions in cases of bridges
« constructed in longitudinally and trans-
« versely pre-stressed concrete, as well
« as bridges on which the track is laid
« directly on the concrete without bal-
« last, and where the water quickly
« drains away, in certain of these cases,
« as well as in the majority of other
« cases, the use of a waterproof covering
« is recommended.

« Cement mortar casings can give
« good results when the structures they
« protect are sufficiently rigid. In
« general coverings are preferred, made
« of asphalt or consisting of several
« layers of material or fibre, or better
« still glass fibre impregnated with bi-
« tumastic materials and even metal
« sheets (generally copper) or sheets of
« plastic materials.

« In view of the importance of the
« casings for the proper conservation of
« the bridges and the difficulties encoun-
« tered in renewing them, it is necessary
« to try and get casings which will last
« as long as the bridges they protect.
« In this connection, the recent intro-
« duction of plastic materials has to date
« given satisfactory results. It is to be
« hoped that the use of thermo-plastic
« materials will make it possible to ob-
« tain this result, provided the casing
« itself is suitably protected against
« damage of a mechanical nature.

« For this purpose, the use of a pro-
« tective coat, generally of concrete or
« mastic asphalt is to be recommended.

« 15. If the masonry or concrete
« bridge is threatened with deterioration
« due to a lack of watertightness and
« when operating reasons prevent the
« carrying out of repairs to the casing,
« waterproofing processes may be used
« applied to the soffits or through them,
« making it possible to reduce permea-
« bility effectively or even doing away
« with the drains altogether.

« 16. Heavier loads and higher speeds
« can be allowed over old masonry
« bridges than those provided for when
« they were designed, provided a very
« careful check is made of the condition
« of the bridge; calculations for veri-
« fying the strength are not generally
« considered necessary.

« Carrying out work to strengthen
« masonry bridges with the sole object
« of allowing heavy loads over them is
« consequently in practice unusual.

« 17. The work of repairing or
« strengthening the arches involves spe-
« cial precautions to avoid abnormal
« distribution of the stresses (anchoring
« irons, ribs, lagging, centering).

« Partial remaking of the arches is ad-
« vantageous if it only affects a relatively
« restricted portion of the bridge and if
« the condition of the remainder of the
« arch, abutments and foundations is
« such that a long useful life can be
« expected from the repaired bridge.

« 18. The organisation of the inspec-
« tion and maintenance of bridges varies
« according to local circumstances; it is
« not possible to establish any general
« rules concerning the most rational
« maintenance methods for bridges.

« Where the roads are adequate so
« that it is easy to get to the place of
« work by road, it may not be advan-
« tageous for the railway to do the work
« itself, unless there is only a small
« amount of work to be done.

« The geographical position and oper-
« ating conditions on the railways may,
« on the other hand, make it advanta-
« geous to carry out work of greater
« importance, or even oblige the rail-
« way to do all its own maintenance
« work without distinction.

« 19. Those Administrations who
« themselves carry out maintenance

« work of some importance have spe-
« cialised gangs, generally used exclu-
« sively on the maintenance of metal
« bridges.

« 20. The materials needed for the
« repairs carried out by the bridge gangs
« are generally supplied from the stocks,
« stores or depots of the Administra-
« tions, whereas those needed for work
« carried out by contractors are sup-
« plied by the latter.

« Several Administrations, however,
« prefer to supply in all cases the paint
« needed to repaint metal bridges. »

QUESTION 2.

Very long rails. Welding methods. Transport of long welded rails and necessary equipment for transporting, laying, fixing, ballast, tamping, etc.

Economic aspect of the question. Present tendencies.

Preliminary documents.

Report (America [North and South], Australia [Commonwealth of], Burma, Ceylon, Egypt, India, Irak, Iran, Republic of Ireland, Japan, Malaysia, New Zealand, Norway, Pakistan, South Africa, Sudan, Sweden, Union of Soviet Socialist Republics, and the United Kingdom of Great Britain and Northern Ireland and dependent overseas territories), by F. JACKSON. (See *Bulletin* for March 1958, p. 379.)

Report (Austria, Belgium and Colony, Bulgaria, Cambodia, Czechoslovakia,

Denmark, Ethiopia, Finland, France and French Union, Western Germany, Greece, Hungary, Indonesia, Italy, Lebanon, Luxemburg, Netherlands, Poland, Portugal and overseas territories, Rumania, Siam, Spain, Switzerland, Syria, Turkey, Viet-Nam and Yugoslavia), by A. CRESPO MOCORREA. (See *Bulletin* for August 1958, p. 1147.)

Special Reporter : A. JACOBS. (See *Bulletin* for September 1958, p. 1345.)

DISCUSSION BY THE SECTION.

Meeting of the 2nd October 1958.

PRESIDENT : Mr. F. PEREZ VILLAMIL.

The President (in French). — Gentlemen, I invite M. JACOBS, *Principal Secretary* for the Section and *Special Reporter* for Question 2, to take part in the debate.

I also ask Messrs. JACKSON and CRESPO MOCORREA, *Reporters*, to joint the Officials.

As everyone will certainly have made themselves familiar with the *Special Report*, I suggest that we do not read

it, but go on immediately to examining the Summaries. (*Agreed.*)

I will therefore ask M. JACOBS to read them in turn.

Mr. Jacobs (in French) :

Summary No. 1 :

1. The name and characteristics of « long welded rails » (L.W. R.) is given to continuous rails of at least 100 m (328' 1"), whatever method be used to assemble them.

Mr. Lohmann, Netherlands Railways. — Several railways weld together in the track rails of sidings, specially when they are fixed into the ballast and including when switches are used. The questionnaire did not include this but only dealt with track. Is it proposed to include something to supplement this, such as «except those in sidings»?

The President (in French). — There are also tunnels.

Mr. Portmann, Swiss Federal Railways (in French). — In my opinion, there is a certain lack of agreement between the title and the subject matter of the report. I think it would have been better to speak of jointless track or very long rails. In fact, the rail is only one of the components of the track, and it is the technique of jointless track which is dealt with in the report.

In addition, to fix a limit of 100 m for long rails seems to me somewhat arbitrary. It would be better either to agree to adopting a multiple of the lengths supplied by the rolling mills, or to fix a length experimentally.

I suggest the text of Summary No. 1 be modified as follows

«The name jointless track is given to track with very long welded rails which are much longer than the rails supplied by the rolling mills, the length being sufficient to avoid any general creeping of the main body of the track.»

Mr. Dunton, London Transport Executive. — We would prefer simply the words «long rails» rather than «long welded rails». I think that would really

be somewhat in accordance with Mr. PORTMANN's point. The technique which we are discussing is the technique of long rails. In my Administration the long rails, which are half a mile long, are made up partly by shop welding and partly by a kind of fixed bolting at the intermediate joints equivalent to welding with bolts so that a fixed joint is obtained perhaps with high tensile bolts and, in some cases, by use of cast iron grit in the joint.

Mr. Jacops. — It is therefore a question of fishplates with bolts without any play?

Mr. Dunton. — We would prefer just «long rails» and we would agree «long welded track» in which the rails provided by the manufacturers were connected in lengths above whatever may be decided. I have no strong views on the 300 ft. but we could say «in long lengths», that would satisfy me.

Mr. Jacops. — Always with fishplates?

Mr. Dunton. — No, 300 ft. lengths are welded, but between those we have fixed bolts.

Mr. R. Lévi, French National Railways (in French). — It is in fact fishplated joints but anchored.

Dr.-Ing. Schramm, German Federal Railway. — There is a difference between short rails, long rails, and long welded rails. The characteristic feature of long welded rails is, that there is no longitudinal movement in the center section.

That is why I disagree with Mr. PORTMANN on this point. Mr. JACKSON's question reads : « After what length does your Administration make use of the expression « long welded track » ? My reply is : « When we speak of a « long welded track section » we refer to a section of track where there is no longitudinal movement in the center part i.e. in that part, the change in longitudinal stresses is of exactly the same ratio as the change in temperature. The condition of « long welded track » will exist in any track section which has been laid without joints. The part length at both ends of a long welded rail where movements may occur is called the « breathing length ». This breathing length may vary and depends on the cross section of the rail and on the resistance of the track against longitudinal displacement (ballasting, fastenings). With good fastening the breathing length at each end of a long welded rail is about 100 ft. so that when rails with a length of 200 ft. and more are used, we have the condition of a long welded track. Generally, 300 ft. may be assumed to be the limit for a continuous welded track condition.

Mr. Jacops (in French). — I think everyone is right from his own point of view. The definition given by Mr. SCHRAMM is the only one which corresponds to the question as set.

I think the first thing to do is to go back a little and examine the remark made by Mr. LOHMANN. This did not exactly refer to a summary but rather to an introductory text. As unfortunately, I am the author of that text, I accept the remark but I doubt whether it is right to stop at this now.

To return to the first summary, is everyone agreed that the name and characteristics of long welded rails (L.W.R.) be given to continuous rails at least 100 m long ?

I think Mr. KLAREN, of the Netherlands Railways, wants to object.

Mr. Klaren, *International Railway Union* (in French). — I am not going to object but I want to suggest a few additions to the text.

The characteristics of L.W.R. are well explained in Question 2 when it is stated that by L.W.R. we mean a rail the central portion of which never moves in any way as a result of temperature variations.

The definition in Summary No. 1 which says that L.W.R. are continuous rails at least 100 m long might give rise to misunderstandings. It is true that a length of 100 m might be sufficient under favourable conditions of temperature rises of the surface of the rail profile and the resistance of the ballast relatively to the longitudinal movement of the body of the track. But a length of 100 m would not be sufficient under less favourable conditions with great overall temperature variations, with large rail profiles and sometimes little resistance of the ballast as regards longitudinal movement in the end parts of the L.W.R., which are called the « breathing » parts of L.W.R.

This is why some Railways in their replies to Question 2 gave as the minimum lengths for L.W.R. values of 60 to 100 m whilst other Railways gave estimates of up to 300 m.

Therefore for Summary No. 1, I would like to suggest a definition as follows :

« The characteristic property of L.W.R. is the presence of a central part *at least*

15 m long, which never undergoes any movement due to temperature variations. This implies that there must be a complete thermic compression force in this central part and that this force must be built up in the ends of the L.W.R. which make up the breathing lengths, in which longitudinal movements of the body of the track give rise to the passive resistance of the ballast against the sleepers which is necessary for equilibrium with the compression force in the central part.

« This breathing length is practically in linear proportion with the rise in temperature, with the surface of the rail profile and the reciprocal value of the resistance of the ballast per unit of length.

« Consequently, L.W.R. must have a minimum length of some 60 m under extremely favourable conditions, up to about 300 m when the climatic conditions, rail profile and resistance of the ballast are less favourable. »

Perhaps, this text is rather long, but it could be shortened.

Mr. Jacops. — The characteristic of long welded rails is therefore the presence of a central part of at least 50 ft. (15 m) which never undergoes any movement as a result of temperature variations. This necessitates that in the central part the complete temperature stress must be developed and accordingly compression force must be built up in both ends of the long welded rail. This is called the « breathing length » and it is in this part that the resistance accumulates. This « breathing part » is the moving section of the rails and as a result the long welded rail has a minimum length of about 300 ft. (100 m) in extremely favourable

conditions, and up to about 1 000 ft. (300 m) in unfavourable conditions of climate, fixing, and ballasting.

Mr. Dunton. — Absolutely correct technically but might be difficult to apply as an agreed definition.

Mr. R. Lévi (in French). — I think the Summaries of the Congress should be concise and definite; they cannot be a railway course, so in my opinion we should retain the original wording with the corrections suggested by Mr. SCHRAMM. This seems quite sufficient to me...

Mr. Jacops (in French). — Mr. SCHRAMM gave the definition which seems to be the best as far as its meaning goes; it agrees moreover with that given in the report. I consider however that we should simply give a figure in answer to the question asked, which was worded as follows : « After what length does your Administration consider rails to be L.W.R. ? »

Perhaps the question itself was not altogether right.

Mr. Julien, *Ministry of Public Works and Transport, France* (in French). — It is a question of defining what is meant by a long welded rail.

Everyone knows what a rail is; a long rail is a rail at least 100 m long. « Welded » ? It is welded no matter what method is used for assembly. Consequently, the text seems to me to correspond perfectly to the definition and I suggest that no alterations be made.

Mr. Jacops (in French). — You are right, Mr. JULIEN, but the length of 100 m is a debatable point.

Mr. Julien (in French). — It is quite enough to give a minimum length.

Mr. R. Lévi (in French). — I think it would be better not to give any figure; the lengths in each country correspond all right with the definition given by Mr. SCHRAMM, but these lengths are not the same in every country. There are some countries where there are only very slight variations in temperature, others where they are very great. In some countries, the friction of the track on the ballast is slight, in others, high.

Consequently, it seems to me impossible to give any absolute value.

Mr. Dunton. — I think we can perhaps say that a long welded rail is a rail in which there is no expansion movement in its middle part, and then to say, that under average conditions this length is above 100 m.

Mr. Julien (in French). — It is essential to state after what length they are long.

Mr. R. Lévi (in French). — They are long as soon as there is no movement in the central part. In practice, we know the length is about 100 m.

Mr. Julien (in French). — It would be more precise to give a length.

Mr. R. Lévi (in French). — No.

Mr. Crespo Mocorrea, Reporter (in French). — It depends on the country.

Mr. Williams, Malayan Railway Administration. — Mr. PRESIDENT, I suggest we leave it exactly as it is. Everybody

understands it and we are talking about long welded rails, not track. When you bring out the rail from the shop it is butt welded. It can move about anywhere it likes. It has been butt welded into 400 ft. (120 m).

Mr. Jacops. — That is not the meaning intended here.

Mr. Williams. — Then I suggest long welded « track » and not « rails ».

Mr. Cividalli, Italian State Railways (in French). — I suggest saying: the minimum length of L.W.R. varies as a function of climatic conditions.

Mr. Jacops repeated this in English and added: Gentlemen, we must reach some conclusion. I suggest we draw up a text with the following meaning:

« The name and characteristics of « long welded rails » (L.W.R.) are given and attributed to continuous rails *whose length varies between 100 and 300 m* » perhaps we might add: « according to the country » ? or: « between 100 and 300 m » ?

A delegate (in French). — The average, is 100 m.

Mr. R. Lévi (in French). — About 100 m.

Mr. Jacops (in French). — I think I may say that all the Railways have not always understood it in the same way. The total temperature variations are not so considerable from one country to another. (*Interruptions.*)

Mr. Julien (in French). — What is bothering you; suppose we reverse the two ideas, suppose we define long welded rails without saying anything about their characteristics : L.W.R. are rails whose central parts are not affected by temperature variations, the lengths generally being of the order of 200 m, or : the minimum length being 100 m.

I think that would agree with what you mean, without having to speak of their characteristics.

Mr. Crespo Mocerrea (in French). — It is not a minimum, but the average.

Mr. Jacops (in French). — You are suggesting we say : « The name L.W.R. is given to continuous rails whose central part... » ? But this does not answer the question asked which was : « After what length does your Administration make use of the term « long welded rail », it being understood that by this is meant a rail whose central part is never affected by any movement due to temperature variations ? »

The definition is given.

Mr. R. Lévi (in French). — That is excellent.

Mr. Jacops (in French). — It was the people who drew up the Questionnaire who did the work so well.

But the question is : after what length is the term « L.W.R. » used ?

Mr. Cividalli (in French). — It is a question of the minimum length which can be called a long welded rail, i.e. in the case of rails whose central part corresponds with the definition given regarding the effects of temperature variations.

Mr. Dunton. — Is it proposed to repeat the definition of the long welded rail as being one having no expansion movement in its centre ?

Mr. Jacops. — It could be done.

Mr. R. Lévi (in French). — Very good.

Mr. Klaren (in French). — I am going back to Mr. CIVIDALLI's definition : The length varies according to climatic conditions and is of the order of... or else : varies according to climatic and ballast conditions.

Mr. Crespo Mocerrea (in French). — And also the type of fastening.

Mr. Jacops (in French). — So we will keep the figure of 100 m given ? That is the figure which corresponds to the answers received.

Mr. R. Lévi (in French). — It will not be repeated in the text of the summary. It is simply an indication.

Mr. Jacops (in French). — In reality, the reply to the question needs an indication.

If the Meeting agrees, we will correct the wording after the session. (*Agreed.*)

The President (in French). — We will therefore leave the text of Summary No. 1 for the time being.

Mr. Jacops (in French) :

Summary No. 2 :

2. At the present time L.W.R. have undergone the test of eight years service in various climates, on lines with the heaviest and fastest

traffic, without causing any difficulties. They are the best solution for obtaining at one and the same time smooth running, good conservation of the fixed installations and rolling stock, and a considerable reduction in maintenance costs.

The President (in French). — Are there any comments on this summary ?

Mr. Glendinning, *Secretary*. — In the English text, would it not be better to say « track » rather than « fixed installations » in the second sentence of the summary ?

Mr. Dunton. — I agree. There is also the words « any difficulty ». I am in agreement, but it is a little strong. « Serious difficulty » or « undue difficulty » perhaps, or just « without difficulty ».

Mr. Feyrabend, *French National Railways* (in French). — Mr. PRESIDENT, I would like a small correction to be made to the text. Since the questionnaire was drawn up, a certain time has elapsed, so that French experience of L.W.R. no longer goes back eight years but nine. I think it is necessary to point this out because even one year is important in the case of such relatively short experience.

Mr. Hoorweg, *Netherlands Railways*. — We quite agree with Mr. DUNTON about difficulties. Then, a second remark about the words « the best solution ». We think it should be translated « an excellent solution ». We think it is not too strong to say « an excellent solution ».

Mr. R. Lévi (in French). — We do not know the best.

Mr. Feyrabend (in French). — Our work concerns the present, not the future; at the present time, it is the best.

Mr. R. Lévi (in French). — I quite understand that it can be said it is not the best solution as far as the laying of the track is concerned; but it cannot be denied, I believe, that it is the best solution to give smooth running, conserve the rolling stock, etc... and give a considerable reduction in maintenance costs.

Mr. Jacops (in French). — At the present time, it is the best solution. It is the best solution we know; perhaps a better one will be found in the future.

Mr. Hoorweg. — We might, probably.

Mr. Jacops (in French). — Would you like us to say : « ... the best solution known at the present time » ?

Mr. Julien (in French). — I would really like to know if it is true that L.W.R. have never given rise to any difficulties in any country ?

Mr. Williams. — I suggest « undue difficulties ».

Mr. Dunton. — I would prefer « without difficulty ». There have been less difficulties on our lines than with short rails.

Mr. Josse, *French West African Railways* (in French). — Before answering Mr. JULIEN, I want to ask him if he counts incidents as difficulties ?

Mr. Julien (in French). — Yes.

Mr. Josse (in French). — On our lines and also on other railways there have been a few incidents, for example broken welds or even deformation of the track. This has been overcome. But if such incidents are to be considered difficulties, the text of the summary should be altered.

Mr. Dunton. — That is a question of the maintenance technique applied.

Mr. Jacops (in French). — I think I can answer Mr. JOSSE by saying that broken welds also occur in 54 or 60 m long rails used by some railways; such broken welds are not confined to long welded rails.

As regards buckling of the track, this has also occurred with short rails as well as long rails. If it is commoner with long rails, it can be called a drawback; but I am under the impression that no complaints have been made under this heading.

Mr. Crespo Mocerrea (in French). — Buckling has occurred with rails only 12 m long !

Mr. Josse (in French). — And even with 6 m long rails.

Mr. R. Lévi (in French). — To take Mr. JULIEN's question into account we could add, if this is considered advisable, that there are no difficulties special to long rails provided the necessary precautions are taken.

Mr. Jacops (in French). — This is the subject of another summary.

The text of Summary No. 2 will therefore read :

« 2. At the present time long welded rails have undergone the test of *nine years' service* in various climates, on lines with the heaviest and fastest traffic, without causing undue difficulty. They are the best solution known today for obtaining at one and the same time smooth running, good preservation of the track and of the rolling stock, and for reducing considerably the maintenance costs. »

— *Adopted.*

Mr. Jacops (in French) :

Summary No. 3 :

3. From the theoretical point of view, there are no limits to the length of L.W.R., for this reason the determination of the actual continuous length the most suitable in practice is based on practical considerations. These have not been selected identically by the different Administrations.

Certain Railways fix this length simply according to operating requirements (isolating joints, track equipment, etc.), whereas others consider that a length of 800 to 1 000 m (2 600' to 3 200') should not be exceeded, for reasons of convenience.

There is an unanimous opinion that long rails should not be used on curves of small radius, but the limiting radius of curve varies considerably according to the Railways: in general, a radius of 500 m (1 600') is considered the minimum admissible on standard gauge lines; in the case of lines of less than standard gauge it would appear that a higher limit, in the vicinity of 800 m (2 600'), is desirable for security.

Mr. Dunton. — I would like to raise a point on the last word of the second paragraph, that is the word « convenience ». I think it is really « maintenance requirements ». In my opinion « convenience of maintenance » might be best.

Mr. R. Lévi (in French). — I should like to make a small comment about the second paragraph.

In general, on our Railways, the length has been limited to 800 m, but there is no reason to be too strict, because there are no absolute obligations in the matter. Perhaps, we could say : « ... whilst others consider it *advisable* not to exceed... » because there is no obligation in the matter.

Mr. Jacops (in French). — Personally, I do not agree because, if a limit is to be fixed, we should fix one limit and not two. Do you want to say : « ... whilst others consider it advisable not to exceed 800 m... ?

Mr. R. Lévi (in French). — My suggestion was that we should not say : « ... whilst others consider that *it should not exceed...* »; I prefer : « ... whilst others consider *it advisable* not to exceed... ». It is simply a question of *advisability* and not a question of *safety*.

Mr. Dunton. — « Convenient », or « desirable », or « wise ».

Mr. R. Lévi (in French). — That agrees with the French word « *opportun* ».

Mr. Jacops (in French). — I will reread the altered paragraph :

« Certain Railways fix this length simply in accordance with operating requirements (track equipment such as insulated joints, and switches and crossings); whereas others consider that it is *not desirable* to exceed a length of 800 to 1 000 m.

Mr. Feyrabend (in French). — In the third paragraph, it would be better to say : « ... but the limiting radius varies considerably according to the Railway and *type of sleepers used...* »

Mr. Jacops (in French). — Does not this come to the same thing ?

Mr. Feyrabend (in French). — Not at all, otherwise I would not ask for : « ... according to the type of sleepers used... ». I am speaking from our actual experience.

Mr. Jacops (in French). — Each Railway has its own...

Mr. R. Lévi (in French). — One precise statement : in France, the minimum radius of 800 m applies to wooden sleepers; the radius of 500 m to concrete sleepers.

Mr. Nicolas, *Cameroons Railways* (in French). — It seems to me that it is difficult to agree to the conclusions of the first and last sentences of the third paragraph. It says in effect : « It is unanimously agreed that long rails should not be used on small radius curves... » and later on : « ... in the case of narrow gauge lines it appears that a larger radius, — of the order of 800 m — is necessary to assure safety. »

In the Cameroons, we have welded the rails from one station to the next over lengths of 5 km on about 100 km of lines. On these 100 km, there are 37 km of curves of 500 m or less; i.e. 4 km of 500 m curves, 8 km of 300 m curves; 9 km of 200 m curves, 13 km of 150 m curves and 3 km of 120 m curves.

No incidents have occurred on these curves, and consequently I think we should go back to Mr. CRESPO's summary which merely stated : « On metre gauge lines, L.W.R. are used on curves of much smaller radius, even below 200 m. » We might add : « when climatic conditions are favourable. »

Mr. Jacops (in French). — May I at once say that Mr. JACKSON has come to the opposite conclusion; this has been the subject of an exchange of opinions between us. One of the Reporters in dealing with metre gauge line gave a minimum radius much below 500 m, which is used on standard gauge lines; the other Reporter gave a much higher minimum radius.

Mr. Nicolas (in French). — But these are the facts, Mr. Reporter; they should be our guide.

Mr. Jacops (in French). — I am not concerned with the ideas of the Reporters, but with the replies received from the Railways.

Mr. Nicolas (in French). — It is for the Congress to decide; I am merely pointing out that in the Cameroons much sharper curves have been laid with welded rails for several years and there have never been any incidents.

Mr. Josse (in French). — I wish to confirm Mr. NICOLAS's statement, and ask for an appreciable modification to the last paragraph; if you like, I will suggest a suitable text.

In the case of standard gauge lines,

a radius of 500 m has been fixed. In general, the Administrations who replied to the Questionnaire were standard gauge railways in temperate countries; the greater part of their lines have curves whose radius definitely never falls below 500 m; but if we turn to the narrow gauge Railways, we find that there are only two such Railways as far as the countries of the English report are concerned : the South African Railways and the Japanese Railways.

The South African Railways have only welded 1.6 km on a system of 20 277 km; the Japanese Railways have welded 73 km on a system of 22 860 km.

In South Africa, the variations in temperature, although greater than in Tropical Africa, are nonetheless small; in Japan they are perhaps somewhat greater but in view of the small proportion of welded rails, it appears that the Japanese have begun by welding the rails where this was most easily done, and that is why they have not gone below 800 m radius.

On the other hand, in the case of the Questionnaire to the French speaking countries, the narrow gauge Railways who replied had at that time more than 200 km and at the present time more than 250 km; they therefore represent a higher proportion.

As Mr. NICOLAS has said, in the Cameroons, radii of as little as 120 m have been welded without any drawbacks; in the Dakar-Niger, we have nothing below 350 m; we have welded up to 350 m without observing any deformation.

Under these conditions, it appears that the summary as worded at present is

dangerous because the word « safety » is used. It is affirmed, in fact, that only a radius of 800 m can assure safety; now the experience of our Administration would appear to contradict such a statement absolutely.

That is why I suggest the following text :

« The track can be welded on curves, but the limiting radius admissible depends upon several factors, especially the annual temperature range. In the case of standard gauge lines in temperate countries, 500 m is usually the limit; in tropical countries, considerably smaller radii can be allowed. »

Mr. Jacops (in French). — Could you give a figure ?

Mr. Josse (in French). — Down to about 100 m.

Mr. Jacops (in French). — So the radius can be as little as 100 m.

(He sums all this up for the English delegates.)

Mr. Jackson, *South African Railways and Harbours, Reporter*, pointed out that the total extent of L.W.R. in South Africa had considerably increased since the report was written.

Mr. Dunton. — I am of the opinion that welded track can be laid in sharper radius curves, but it is a little early to agree entirely.

Mr. R. Lévi (in French). — As regards the limit applicable to narrow gauge lines, this question does not concern our

Railways; but in view of the fact that a comparison between standard and narrow gauge lines has been under discussion, I think it useful to state that in my opinion there is no reason at all for stating that there is any difference whether the track is wide or narrow, in fact, even if there was merely one rail.

Mr. Josse (in French). — It is possible to mention lines in temperate countries without saying whether they are standard gauge or not.

Mr. R. Lévi (in French). — I think the minimum radius should take many factors into account, variations in temperature naturally, but this is not the only thing.

Mr. Josse (in French). — There are also the fastenings.

Mr. R. Lévi (in French). — No, the fastenings are the last part, but the transverse resistance of the bed; not at all the width of the track.

Mr. Josse (in French). — In tropical countries, the track is generally narrow gauge, whilst in temperate countries it is generally standard gauge.

Mr. Julien (in French). — In some tropical countries, there are wide variations in temperature.

M. Josse (in French). — Bolivia and Mexico, for example...

Mr. Julien (in French). — The Soudan.

Mr. Josse (in French). — The annual variation is less than 50°; in temperate

countries it is much greater. In spite of a definitely higher ambient temperature, reaching 45°, the temperature of the rail does not exceed 55 or 60°. This phenomenon may appear surprising. We have measured the temperature over several years, and I can affirm that in a country with a Sahara climate like the Soudan where there are very high temperatures in the dry season, which may reach 45°, the temperature of the rail never exceeds 55 to 60°, whereas in Europe in the summer the temperature of the rails may often exceed this figure.

The President (in French). — Is it a question of the total variation ?

Mr. Josse (in French). — Of the annual variation.

Mr. R. Lévi (in French). — Of the temperature of the rail.

Mr. Nicolas (in French). — In the Cameroons, the annual variation does not exceed 35°.

Mr. Jacops (in French). — For the rail; not for the air ?

M. Nicolas (in French). — In the case of the air, the variation is even less.

Mr. Jacops (in French). — Since Mr. Lévi has remarked that the gauge of the line should not be taken into account and, on the other hand, in certain tropical countries, the total variation in the temperature may be less than in so-called temperate countries, I am wondering what common conclusion we can arrive at.

Mr. R. Lévi (in French). — We could very well say that in general a radius of 500 m is considered the admissible limit in climates...

Mr. Nicolas (in French). — « Under average climatic conditions... »

Mr. R. Lévi (in French). — « ... in ordinary climates ». The rest will be deleted.

Mr. Nicolas (in French). — It should be pointed out that it is possible to reduce this limit when climatic conditions are exceptional.

Mr. Feyrabend (in French). — « In countries with rather great temperature variations... »

Mr. Nicolas (in French). — We could mention that we can go lower when the climatic conditions are very favourable.

Mr. Jacops (in French). — I will go back to the beginning of the text suggested by Mr. Josse :

« The track can be welded on curves, but the admissible radius depends on several factors, of which the annual temperature variation... »

Mr. Josse (in French). — Yes, instead of « in particular ».

Mr. Jacops (in French). — Could we not say that 500 m is a safe figure ?

Mr. R. Lévi (in French). — No, that depends for example on the type of sleepers used.

Mr. Nicolas (in French). — We are the masters as regards the type of track but not of the climate.

Mr. R. Lévi (in French). — There are some Railways which use two different types of sleepers.

Mr. Nicolas (in French). — They can if they please, but they cannot choose the climate

Mr. Dunton. — I don't feel that it is certain that the radius for narrow gauge railways should be the same as for normal gauge railways. There is a difference in the beam strength according to the gauge of the track. I feel it is probably wise still to treat it in two separate sections, one for light railways, and one for the other railways.

M. Josse (in French). — I do not think so; there is no valid reason for bringing out this difference.

Mr. Jusseau, *Algerian Railways* (in French). — In Algeria, we have 2 500 km of standard gauge and 1 700 km of narrow gauge lines, and I confirm completely the observation made by Mr. Robert LÉVI: there is no need to make any distinction. On the other hand, there is a very important distinction to be made and that is the type of sleepers.

At the present time, we are making trials of welded rails — 30 km — on metal sleepers; We are completely satisfied. I would like Mr. JOSSE's remark to be retained, when he spoke of safety.

At present, we are still getting experience, and I would not like any figure given in the report which might be used against

us should exceptionally some incident occur.

Mr. Josse (in French). — I did not dare to say so.

Mr. Dean, *British Railways*. — Why fix any limit ?

Mr. Jacops (in French). — Is it Mr. JUSSEAU's conclusion that in one way or another the term safety should be retained ?

Mr. Jusseau (in French). — No, no. On the contrary: It should not be retained.

Mr. Feyrabend (in French). — Your text is much too affirmative.

Mr. Josse (in French). — That is why I did not include this expression in my proposal.

Mr. Julien (in French). — The text of paragraph 3 could end after the words: « ... est très variable selon les Réseaux. » (... is very variable according to the Railways.)

Mr. Jacops (in French). — That no longer would mean anything.

Mr. Josse (in French). — It is necessary to make known the results of the experience of the Railways taking part.

Mr. Dunton. — I think it would be wise to say: it still requires further examination and determination.

Mr. Feyrabend (in French). — It is really not a very brilliant conclusion; it

hardly seems worth while having worked for two years in order to arrive at such a conclusion.

In fact, it is my impression that we are more or less agreed and it simply remains to find the right wording for a whole.

Mr. Nicolas (in French). — I repeat, we have curves of 120 m.

Mr. Josse (in French). — We have no curves of less than 350 m.

Mr. Feyrabend (in French). — Each Railway has its own curves.

Mr. Crespo Mocerrea (in French). — You use metal sleepers on these 120 m curves.

Mr. Jacops (in French). — Gentlemen, could we not simply make the summary a statement of facts ?

Mr. Nicolas (in French). — Yes.

That was what Mr. CRESPO's summary was. On metre gauge railways much lower radius curves are allowed, even less than 200 m.

Mr. R. Lévi (in French). — In certain countries ?

Mr. Feyrabend (in French). — In countries with favourable climates.

Mr. Jacops (in French). — Do you wish to adopt Mr. CRESPO's summary ?

Mr. Nicolas (in French). — In that case, I suggest we leave out the words :

« On metre gauge railways » and simply say : « When climatic conditions are favourable L.W.R. are used on curves with much smaller radii, even less than 200 m. »

Mr. Feyrabend (in French). — Mention must also be made of the kind of sleeper.

Mr. Jacops (in French). — What about saying : « When climatic conditions and the *constitution of the track* are favourable... »

Mr. Feyrabend (in French). — With an unfavourable type of sleeper, you cannot even allow a radius of 500 m.

Mr. Jacops (in French). — Here is the text of Mr. CRESPO's report :

« 4. Most of the Administrations tend to lay their standard gauge lines with L.W.R. if the layout in plan does not include curves of less than 500 m radius when the rails are laid on concrete sleepers, and 600 to 800 m in the case of wooden sleepers. In curves of lower radius than the above, the line is made up with rolled or welded rails of the length usually used by each railway, and although opinions do not agree, the present tendency is to lay these rails with staggered joints.

« On metre gauge railways, the L.W.R. are laid on curves of much smaller radius even below 200 m. »

I do not know whether we should mention staggered joints, but perhaps we can keep the phrase : « In curves of lower radius than the above... » But it is true that this is no longer necessary.

Mr. Nicolas (in French). — Will the paragraph end after « ... of wooden sleepers. »

The President (in French). — « ... in the case of wooden sleepers. »

Mr. Unal, Secretary (in French). — And the metal sleepers ?

Mr. Jacops (in French). — The second part of the paragraph will then read as follows : « When climatic conditions and the constitution of the track are favourable, *certain Railways have gone down to much smaller radii, even 100 m.* »

Mr. Feyrabend (in French). — « ... which can go down... »

Mr. Crespo Mocerrea (in French). — « ... to radii of *even less than 200 m.* »

Mr. Jacops (in French). — From the experience obtained we can take the figure of 120 m.

Mr. Feyrabend (in French). — **Mr. CRESPO's** suggestion in favour of « even less than 200 m » is more cautious.

Mr. Nicolas (in French). — I think so.

Mr. Feyrabend (in French). — I keep on the side of caution.

Mr. Jacops (in French). — I will read the new wording :

« The greater number of the Administrations tend to equip their standard gauge lines with L.W.R... »

Should we say : « standard gauge » ? (*No, no*). So we will say :

« The greater number of Administrations *equip their lines with L.W.R.* when the layout of the latter does not include any curves of less than 500 m radius in the case of concrete sleepers, or 600 or 800 m in the case of wooden sleepers. When climatic conditions and the constitution of the track are *particularly favourable*... » ? (*Yes, yes*).

Mr. Feyrabend (in French). — It is the case for the 30 kg rail.

Mr. Jacops (in French). — « ... are particularly favourable, certain Railways even go below radii of 200 m. »

He translated into English the summary originally given by **Mr. CRESPO**, adding the variations which had been discussed.

Mr. Dunton. — I have heard it said that there is no difference between metre gauge and wide gauge railways in experience, but I think that relates to steel sleepers.

Mr. Jacops. — We are speaking in the text here of wood or concrete.

Mr. Dunton. — Yes, but we assume there is no difference between normal and narrow gauge. Assuming we are taking that statement — but was that not with steel sleepers only ?

Mr. Jusseau (in French). — It was a question of metal sleepers.

Mr. Feyrabend (in French). — On narrow gauge lines ?

Mr. Jusseau (in French). — Only on narrow gauge lines.

Mr. Josse (in French). — We have welded both on concrete and metal sleepers; we have not found any difference in the way the track behaves. It is a question of prestressed concrete sleepers of a type that is already old; the thing was done ten years ago.

I think the summary should not ignore metal sleepers, which are used by a certain number of Railways just as much as wooden and concrete sleepers.

I think that the lateral resistance of metal sleepers, in the case of a line which receives normal maintenance, is just as good as that of concrete sleepers.

Mr. R. Lévi (in French). — Excuse me but lateral resistance is not the only thing to be considered; there is the weight; if a metal sleeper is displaced laterally, a lifting movement occurs at the same time. It is better not to be too precise on this point; it is rather controversial.

Mr. Jacops (in French). — Would it not be better not to mention wood or concrete? Or would you prefer to speak of 500 m without mention of the type of sleeper?

Mr. Feyrabend (in French). — At the end of the summary, we speak of climatic conditions and the constitution of the track; a 30 kg rail is certainly a very favourable factor in the experience of the Delegates whose opinions we have just heard.

Mr. Josse (in French). — For curves. For straight sections, on the contrary, it is unfavourable.

Mr. Feyrabend (in French). — The expression « favourable conditions » corresponds to conditions in which the track — rails and sleepers — are laid; it is the whole which must be considered.

Mr. Jacops (in French). — We wish to retain the beginning of Mr. CRESPO's summary: « The greater part of the Administrations tend to equip their lines with L.W.R. if the layout of the latter does not include any curves of less than 500 m radius when laid on concrete sleepers, or 600 to 800 m when wooden sleepers are used. » Would it not be possible to simplify this sentence?

Mr. R. Lévi (in French). — « ... as a function of the climatic conditions and constitution of the track »?

Mr. Nicolas (in French). — What about saying: « ... 500 to 800 m according to the type of sleeper »?

Mr. Feyrabend (in French). — No absolute limit should be laid down.

Mr. Jacops (in French). — Give a limit which is admissible in every case?

Mr. Feyrabend (in French). — That would be inconvenient for everyone.

To fix 800 m as the minimum, means taking the most unfavourable case and making it apply to everyone.

Mr. R. Lévi (in French). — « ... of the order of 800 m in the case of wooden sleepers » as an indication. We have had curves of 710 m and with concrete sleepers, curves of 330 m radius.

Mr. Nicolas (in French). — Could we not say : « ... from 500 to 800 m according to the type of sleepers » ?

Mr. Crespo Mocerrea (in French). — The Germans go down to 500 m.

Mr. Nicolas (in French). — With metal sleepers ?

Mr. Crespo Mocerrea (in French). — No, concrete.

Mr. Feyrabend (in French). — That is it, 330 m with concrete sleepers in certain cases.

Mr. Jacops. — What do you do in Germany, Dr. SCHRAMM ?

Dr.-Ing. Schramm. — In Germany, we go down to curves of 500 m and in some test cases even to 250 m. When we first started through welding of rails we preferred tracks laid on concrete sleepers. Now, after having gained sufficient experience, we weld rails no matter on what type of sleepers they are laid, concrete, wooden or steel sleepers.

Mr. Williams. — We have had long rails of 660 ft. with 10 chains radius and have had no trouble, on timber sleepers.

Mr. Nicolas (in French). — Could we not say — I am repeating my previous suggestion : « ... of 500 to 800 m according to the type of sleepers » ? This would give an indication of the radii actually allowed : everyone could use wooden sleepers, or concrete or metal wherever they pleased.

Mr. Jacops (in French). — To go back to the text : « The greater number of the Administrations tend... » are we going to keep the word : *tend* ? « ... to equip their lines with L.W.R. if the layout of the latter does not include curves of less than 500 or 800 m radius, *according to the type of sleepers*. »

Mr. R. Lévi (in French). — Perhaps, it would be better to end the sentence after : «... 500 to 800 m » and then say : « The use of smaller radii depends on the districts and constitution of the track. »

Mr. Nicolas (in French). The question of the radius is dealt with afterwards.

Mr. Jacops (in French). — This wording appears to be quite suitable. The second sentence would be : « When climatic conditions and the constitution of the track are particularly favourable, certain Railways go as far as radii... »

Mr. Feyrabend (in French). — That would be the third sentence. Mr. Robert LÉVI wants to divide into two the unduly long sentence about radii of 500 to 800 m, but the last sentence will remain as it is.

Mr. R. Lévi (in French). — Do you want to cut the sentence after « 500 to 800 m » ?

Then afterwards we could say : « The minimum radius varies according to the districts and the constitution of the track. »

Mr. Jacops (in French). — Let us add for information : « Under particularly favourable conditions, certain Railways use radii of less than 200 m. »

Here is the complete text of Summary No. 3 :

« 3. From the theoretical point of view, there are no limits to the length of L.W.R., for this reason the determination of the actual continuous length the most suitable in practice is based on practical considerations. These have not been selected identically by the different Administrations.

Certain Railways fix this length simply according to operating requirements (insulated joints, track equipment, etc.), whereas others consider that it is not desirable to exceed a length of 800 to 1 000 m.

« Most Administrations have used long welded rails when the alignment did not include any curves of a radius less than 500 to 800 m according to the type of sleeper. The minimum radius varies according to the regions and the track materials. In particularly favourable conditions, certain Administrations have used long welded rails even in curves of a radius of less than 200 m. »

The President (in French). — Any more comments about this Summary, Gentlemen ?

— *Adopted.*

Mr. Jacops. — *Summary No. 4 :*

4. The possible use of expansion devices depends upon the effective length of the rails : those Railways who limit the practical length of their rails to about one kilometre consider it generally necessary to use devices of this kind; on the other hand, those Railways who use long rails of various lengths, only limited by special circumstances, state that ordinary fishplating, completed by numerous anticreep devices, can be satisfactory.

Dr.-Ing. Schramm. — The first sentence of this Summary is not good, because that is only the opinion of some Administrations but not a fact, and I suggest we delete with the first sentence. The reason is that movement is only at the ends of the track but not in the middle and therefore it is the same thing whatever length the rail is. And, I suggest later on to say instead of the last sentence of the Summary, after the word « devices », « on the ends of the long welded rails is giving satisfaction ». The reason is the following. In Germany, on the railways we have on the main lines now about 10 000 km of welded track and in the track we have about 3 000 track joints, i.e. normal joints without dilatation. Our normal joints have a dilatation of 2 cm and we have no trouble therefore, I think we can say « is giving satisfaction » instead of « can be satisfactory ».

Mr. Jacops. — When you speak of the first sentence you mean : « The possible use of expansion devices depends on the effective length of the rails. » Only that ?

Dr.-Ing. Schramm. — Yes.

Mr. Dunton. — I would like to propose an alternative phrase. I think the word « expansion » is wrong. The word should be « adjustment ». The switch which is provided, or the expansion device so-called and wrongly called, at the end of long rails is not a device to permit free expansion or contraction of the rail. It is a device to permit adjustment in the case of difficulty. For instance, in my Administration, at the end of each 800 m

length we provide a joint which can be used for adjustment, but is not normally expanding or contracting. I would suggest the phrase should be « The possible use of devices for the initial or subsequent adjustment of the rails, known as destressing, depends upon the practice of the particular Administration. Some employ these devices », and then go back to the text, « others state that ordinary fishplating, completed by numerous anti-creep devices, etc. » In the event of any difficulty, assuming there is a fracture, or the ballast is bad, or difficulty with formation, it is then possible to de-stress the rail and this de-stressing can be more easily done if there is an apparatus for adjustment at the end of the rail.

Dr.-Ing. Schramm. — I think de-stressing is not necessary.

Mr. Dunton. — Then we say : « Other Administrations think it is not necessary ».

Mr. R. Lévi (in French). — Before we try to find a new text, I would like to add a word to Mr. DUNTON's remarks regarding the value of expansion joints to enable the stresses to be regulated, as there is another point : certain Railways have sometimes been obliged to replace part of a rail, for example when a break occurs, which affects a certain length of the railhead.

I am wondering what Railways, who do not make use of expansion joints, do in such cases — I am thinking of cases when the temperature is high.

Dr.-Ing. Schramm. — We have had broken rails in long welded track, but

they are easy to repair. After cutting out a section of 4 m in length, there are two possibilities for repair. We either replace it by one of equal length using fish plates and wait until summer-time when the temperature is high enough, then we weld it; or we weld the replacement section at once and in spring-time when the ambient temperature is rising the rail is cut again, destressed and rewelded.

Mr. R. Lévi (in French). — I think my question was not formulated sufficiently complete.

How do you set about cutting a damaged rail when the temperature is considerably higher than the temperature when it was laid ?

Mr. Jacops translated this into English.

Dr.-Ing. Schramm. — We make the rails cold. It is possible; but we have no broken rails under high temperature.

Mr. Jacops. — How do you cool the rail ? With ice ?

Dr.-Ing. Schramm. — No, with water. And when the temperature is right we can later cut out and weld again.

Mr. Dunton. — I think that while Dr. SCHRAMM's remarks are very interesting it would not affect the proposed text which is to say that « some Administrations believe in expansion devices but some do not ». I would wish the new text to stand. I think it would cover what Dr. SCHRAMM has told us very well.

I would like to say another word.

Rails under stress can at time be an embarrassment, and that does not only relate to broken rails, it can relate to wash-outs, or conditions which have made the formation and the ballast disturbed. Under these conditions, it is of great convenience to be able to remove the stresses from the rail. I would like to say that: « The use of devices for the initial adjustment and the subsequent adjustment or de-stressing of the rails depends upon the practice of each Administration ». In England we say, when the rail is in high stress, there is a lot of vice in the rail, and we like to be able to get rid of that vice in case of emergencies.

I would like somewhere in the text to see the purpose of the device defined. I think it could be misunderstood unless given somewhere.

Mr. Jacops (in French). — Gentlemen, obviously this is partly a linguistic question. We are not always forced to have an absolutely literal translation, provided the meaning is quite clear, naturally. Though we talk of expansion devices, it is quite permissible for the British to call them — I retranslate into French — regulating devices. (*Agreed.*) **Mr. DUNTON** however wants some reference to be made to the part played by such devices. We could do so, the expansion device is also useful as regards regulation.

Mr. Feyrabend (in French). — Just so.

Mr. R. Lévi (in French). — I think it would be all to the good to include in a sentence, as **Mr. DUNTON** proposed, the reasons why certain Administrations

find it advisable to use expansion devices. These offer several advantages.

Mr. Jacops (in French). — We could say : « The possible use of devices allowing of the *expansion of the rail as well as its initial or ulterior regulation depends on the practice of each individual Administration. Some of them use such devices, others on the contrary accept...* » or : « *agree that ordinary fishplating completed by numerous anticreep devices is satisfactory.* »

Mr. R. Lévi (in French). — I think the French translation does not quite correspond to what **Mr. DUNTON** said. He calls regulation « de-stressing » which in French is doing away with the stresses.

Mr. Feyrabend (in French). — It is to balance things. **Mr. DUNTON** insisted on his wish to eliminate the evil of the important stresses there might be.

Mr. R. Lévi (in French). — He uses the term *de-stressing* for these stresses.

Mr. Jacops (in French). — It means regulation. (In English : **Mr. DUNTON**, will you please repeat what you said ?)

Mr. Dunton. — « The use of devices for the initial adjustment and the subsequent adjustment or de-stressing of the rails depends upon the practice of each Administration. Some employ the devices, others state that ordinary fishplating, together with anti-creep devices can wholly be satisfactory. » Those who employ the devices consider them necessary to remove the stresses from the rail in cases of difficulty.

Mr. Jacops. — Others agree that ordinary fishplating, completed by numerous anti-creep devices, can be satisfactory. The wording proposed by Mr. DUNTON would therefore be :

« The use of devices intended to assure the initial or subsequent regulation of the rails, known as counterbalancing... » or should we say : « The use of devices for the *initial or subsequent counterbalancing...* » ? or : « ... *the initial regulation and subsequent counterbalancing...* » ?

Mr. Feyrabend (in French). — The counterbalancing of what ? Of the stresses.

Mr. Josse (in French). — It is a freeing of the stresses.

Mr. Feyrabend (in French). — It is counterbalancing more than regulating; it is perhaps more technical. The rail does not move, there are no exterior efforts, and if there are any stresses, we counterbalance these.

Mr. Josse (in French). — When the regulation takes place, they are suppressed.

Mr. Feyrabend (in French). — The stresses inside the rail are counterbalanced.

Mr. Jacops (in French). — What about saying : « The initial, regulation and subsequent counterbalancing... » ?

Mr. Feyrabend (in French). — Would you reread the part before this ?

Mr. Jacops (in French). — « The use of devices intended for the initial regulation and subsequent counterbalancing on the stresses depend upon the practice of each individual Administration. Those which use such devices consider that it is essential to suppress the stresses in the rail should difficulties occur. Others... »

Mr. Feyrabend (in French). — The word « individual » appears redundant.

Mr. Jacops (in French). — You want to say : « depends on each Administration » ?

Mr. Feyrabend (in French). — That's right.

Mr. Jacops (in French). — It is not necessary to translate the English text word by word.

« Those who use such devices consider it necessary to suppress the tension in the rails in case of difficulties. »

Mr. Feyrabend (in French). — The tensions ? The compressions ? We must say : the stresses.

Mr. Jacops (in French). — « Others, on the contrary, agree that ordinary fishplating, completed by numerous anti-creep devices, gives satisfaction. »

Mr. Josse (in French). — I want either to suppress « completed by *numerous* anti-creep devices » or to say : « *possibly* completed by anti-creep devices » because from the French report it appears that side by side with an Administration like the Deutsche Bundesbahn which uses

anti-creep devices, there are others who use ordinary joints without any such devices.

In the case of the English report, two Railways use ordinary joints, in particular the American Railways where the track is laid with non-elastic dog-spikes. In such a case, it is necessary to have anti-creep devices. But the summary as now worded appears to imply that anti-creep devices should be used with ordinary joints; but our experience and even the analysis of the reports shows that anti-creep devices are only necessary in special cases.

That is why, if this part of the sentence is to be retained, I want it to be completed by the word : *possibly*.

Mr. Jacops repeated this in English.

Mr. Dunton, — It is a statement of fact. Whatever is true should be put in.

Mr. Jacops. — The text of Summary No. 4 will therefore be :

« 4. The use of devices for the initial adjustment and the subsequent adjustment or de-stressing of the rails depends upon the practices of each Administration. The Administrations which use these devices consider it necessary to de-stress rails in cases of difficulty.

« Other Administrations, on the contrary, consider that normal fishplating, together with a large number of anti-creep devices, give satisfaction. »

— *This text was adopted.*

Mr. Jacops. — *Summary No. 5 :*

5. All types of fastenings which assure close contact between the rail and the sleeper can be used with L.W.R. As far as elastic rail-

spikes are concerned, experience of this device is still insufficient at the present time for a final judgment to be passed.

Mr. Portmann (in French). — Mr. President, Gentlemen, I suggest adding, after « ... close contact... » the words : « *and lasting* », because the time a fastening remains firm is the determining factor.

Mr. Jacops translated this into English.

Mr. Dunton corrected the proposed wording.

Mr. Nicolas (in French). — I should prefer « ... a firm and *constant* contact... » or : « *permanent* » ?

Mr. Feyrabend (in French). — « ... firm and permanent... »

Mr. Jackson. — The Americans use nothing but dog-spikes.

Mr. Feyrabend (in French). — Yes.

Mr. Crespo Mocerrea (in French). — Non-elastic.

Mr. Feyrabend (in French). — And they have to use anti-creep devices.

The words « elastic spikes » in the text proposed, do they refer to spikes thrust into the mass ?

Mr. Crespo Mocerrea (in French). — It is not question of the ordinary dog-spikes used in the United States but spikes of the English type.

Mr. Feyrabend (in French). — I agree. I simply wanted you to make this quite clear.

Mr. Jacops. — The text of Summary No. 5 will therefore be worded as follows:

« 5. All types of fastenings which assure firm and permanent connection between the rail and the sleeper can be used with L.W.R. As far as elastic rail-spikes are concerned, experience of this type of fastening is insufficient at the present time for a final judgment to be passed. »

— *Adopted.*

Mr. Jacops. — *Summary No. 6 :*

6. Although the weight of concrete sleepers makes them particularly suitable for lines laid with L.W.R., they can equally well be laid on wooden or metal sleepers.

Mr. Lohmann. — I suggest an alteration in the text. « Although the weight of concrete sleepers and the shape of metal sleepers make them particularly suitable for lines with long welded rails they can also be laid on wooden sleepers. »

Mr. Feyrabend (in French). — This is contrary to what was said just now, in connection with metal sleepers; there is a danger of the spades starting a lifting movement. We must certainly not mention this as a favourable fact, but as an unfavourable fact; the spade is bad.

Mr. Jacops. — Do you agree Mr. LOHMANN ?

Mr. Lohmann. — Not at all.

Mr. Jacops. — So that we must reach agreement on this point.

Mr. Dean. — Is it not that we want somewhere in this text : « They can

also be laid with security on wooden or metal sleepers. » The purpose of the Summary is that we can have a suitable track, with security. Those are essential words in the text.

Mr. Feyrabend (in French). — I have no objections to this.

Mr. Jacops (in French). — Does Mr. LOHMANN agree ? We are not speaking of the shape of the sleepers, but of metal sleepers. We will therefore say :

« 6. Although the weight of concrete sleepers makes them more suitable for use in tracks laid with L.W.R., such rails can well be laid *with complete safety* on wooden or metal sleepers. »

— *Adopted.*

Mr. Jacops. — *Summary No. 7 :*

7. The ballast should consist of hard, sharp stones, of between 25 and 60 mm.

Wide ballast profiles should be used, the space between sleepers be well filled in and the bench heaped up in order to increase the transversal resistance of the track.

Messrs. Dean and Dunton made comments about the English text.

Mr. Josse (in French). — The summary states that *wide ballast profiles* should be used. This risks taking it to mean that the profiles should be larger than on standard track, though it appears to result from the report that those Administrations already having a sufficient ballast profile on standard track have retained the same profile for their welded track.

I am afraid the wording might give the impression that this is not so.

Could we not say that generally the ballast profile used on non-welded track can be retained for welded track ?

Mr. Unal (in French). — It depends.

Mr. Josse (in French). — Provided the non-welded track is correctly ballasted.

Mr. Feyrabend (in French). — Attention must be called to the importance of the profile on welded track; this is the essential point; it is very often insufficient compared with the theoretical track.

Mr. Josse (in French). — The text gives the impression that a special profile is required with welded track.

Mr. Jacops (in French). — It was stated in the report that the bench should not be more than one metre.

Mr. Feyrabend (in French). — It is essential to retain the initial value of the ballast profile because the trouble as regards maintenance — at least from experience acquired — comes from insufficient ballast profiles. When laid they were sufficient, but ultimately the profiles are reduced.

Mr. Jacops (in French). — Would it not be enough to say that it is necessary to *maintain* full profiles ?

Mr. Legrand, *French National Railways* (in French). — We might say : « It is necessary to maintain a sufficient ballast profile. »

Mr. Jacops (in French). — Sufficient ? It might be wondered what this means...

Mr. Crespo Mocerrea (in French). — « ... a ballast profile *sufficiently wide*. »

Mr. Feyrabend (in French). — Later on it says : « ... and to heap up the bench well... » This might suggest the idea of ramming. If anyone knows how this is done, will he please be good enough to get up and tell us if it is done, who does it...

Mr. Crespo Mocerrea (in French). — The Germans do it.

Mr. Jacops. — Dr. SCHRAMM, don't you vibrate the ballast ?

Dr.-Ing. Schramm. — Yes, we do so, before laying the sleepers.

Mr. Jacops. — But after laying, don't you vibrate ?

Dr.-Ing. Schramm. — Yes, we have begun to do so. We will do it in future. We have a special machine for this.

Mr. Josse (in French). — In fact we should say: pack the bench (shoulder) with ballast and not « heap up the bench... » There must be a sufficient quantity of ballast on the shoulder.

Mr. Feyrabend (in French). — Maintain the profile, therefore ?

Mr. Josse (in French). — The depth of the shoulder as well.

Mr. Jacops (in French). — You are talking of *packing*; it is a question of properly packing the track.

Mr. Unal (in French). — That is all that is required.

Mr. Josse (in French). — The shoulder must be kept sufficiently deep.

Mr. Jacops (in French). — I think the shoulder is sometimes overloaded...

Mr. Feyrabend (in French). — It is the word «tasser» (pile up) which seems to be too strong. How many miles have been heaped up compared with the number of miles laid ?

Mr. Jacops (in French). — None, or nearly so.

Mr. Feyrabend (in French). — Then why make a summary about it ? To recommend such experience seems rather risky to me; our summaries have no absolute value, but at least a certain value.

Mr. Jacops (in French). — Do you want to delete the last part of the sentence ?

Mr. Feyrabend (in French). — Agreed. «... and to pack... »

Mr. Unal (in French). — «To use full profiles... »

Mr. Jacops (in French). — We are therefore in agreement about the following text :

« 7. The ballast should consist of hard, sharp stones, of between 25 and 60 mm in size.

« Wide ballast profiles must be maintained, the space between sleepers should be well filled in and an adequate shoulder provided. »

— *Adopted.*

Mr. Jacops. — *Summary No. 8 :*

8. The method preferred for making L.W.R., both from the technical and economic points of view, is first of all to flash weld in the shops the longest possible lengths of rail, transport these to their destination by suitable rakes, and weld them together on the line by the most suitable method. For this latter, the most widely used method is thermit welding. The above two methods of welding do not require any heat treatment after completion.

Mr. Dunton. — I would not agree the last sentence. We consider they do require heat treatment.

Mr. Jacops. — Most of the Railways do so.

Mr. Dunton. — Can we say « most » of the Railways ?

Mr. Lohmann. — Mr. JACKSON says in his report that heat treatment is perhaps a necessity, it is not the same.

Mr. Feyrabend (in French). — Do many of them consider it necessary ?

Mr. Jacops. — May I ask which Railways consider heat treatment necessary ?

Mr. Lohmann. — The Netherlands Railways.

Mr. Dunton. — The British Railways.

Mr. Josse (in French). — I want to make another comment. It says in the summary that « ... the method preferred, both from the technical and economic points of view is to flashbutt weld in the shops. »

This depends on the size of the shops. The amortisation of a flash butt welding installation, especially in under-developed or colonial type countries, means having large shops, and up to the present most of the shops in such countries could not cope with it.

So I think the present wording goes rather too far; as far as the economic point of view is concerned, it depends on the case, as it is necessary to have a sufficiently large shop if a flash butt welding installation is to pay off.

Mr. Jacops (in French). — It says the method preferred.

Mr. Josse (in French). — But it goes on to say : « from the economic point of view » ? That depends on circumstances.

Mr. Jacops (in French). — Mr. JACKSON notes in his report that on the seven Railways who replied to this question, four use heat treatment, whilst three do not.

Mr. Feyrabend (in French). — It is necessary to know the lengths for which the treatment was used.

Mr. Crespo Mocerrea (in French). — The most important Railways no longer use it, the S.N.C.F., the S.N.C.B., the F.S. and also the R.E.N.F.E.

Mr. Feyrabend (in French). — If they no longer use it, it means they have had experience of it.

Mr. Alexander, Nigerian Railway Corporation. — Mr. CHAIRMAN, I would like to observe in support of Mr. JOSSE that the question of economy is related to many factors, not least of all being availability of electricity to flash butt and the fact you need more than one line in order to get long welded rails out, otherwise you will be in continuous occupation. The statement is rather general and if you have no electrification or only single line, it is more economical to use thermit welding.

Mr. Feyrabend (in French). — I understood Mr. JOSSE's remark from the point of view of amortisation; I do not understand what a single line has to do with it; this in no way stops long rails being prepared in the shops, especially as the unloading of a prefabricated rail in the shop is much simpler and occupies the line for a much shorter time than 18 m ones.

Though I agree with the question of amortisation raised by Mr. JOSSE, the question of a single line cannot give rise to any problems. We ourselves have many single lines on which we use prefabricated rails.

Mr. Nicolas (in French). — As far as the problem from the economic point of view is concerned, the question of handling welded rails also comes into the picture. Are these summaries valid as regards the handling of preassembled track, or only in the case of renewing lines on which a train can run to transport the rails ?

Mr. Feyrabend (in French). — We have been chiefly talking about the operating.

The idea of new lines was not raised in the report; only the question of maintenance was considered...

Mr. Josse (in French). — Mr. ALEXANDER is thinking of the construction of a new line in Nigeria.

Mr. Nicolas (in French). — So am I.

Mr. Jacops (in French). — Could we not reconcile all these points of view by suppressing the end of the sentence : « both from the technical and economic points of view » ?

We would say : « The method preferred is to... »

Mr. Nicolas (in French). — It cannot be preferred in every case.

Mr. Josse (in French). — « The method generally preferred... »

Mr. Feyrabend (in French). — Those who can buy a welding plant, buy one. I prefer to mention the technical idea. In my opinion, we should keep the word preferred.

Mr. Nicolas (in French). — Perhaps we could make it clear that this relates to the renewal and not the laying of a new line ? In such a case we could not say we preferred one method to another if the other method had not been tried.

Mr. Feyrabend (in French). — I agree.

Mr. Jacops (in French). — If you are able to do it in the shop, you do it.

Mr. Nicolas (in French). — Our summaries may have a certain value in the case of many miles of line to be laid; if the summaries do not refer to new lines, this must be stated.

Mr. Feyrabend (in French). — Some very easy method of laying might be perfected.

Mr. Josse (in French). — A shop which does not belong to the district which moves on every 10 km and rails only 50 m long ?

Mr. Feyrabend (in French). — It would be a beginning; it could be extended perhaps later on. Experience has shown us that the additional transport lane does not cost a lot and on the contrary is profitable owing to the maintenance facilities it gives; it can be used for laying new lines. I am not prejudiced, but I do not see any way of solving the problem technically.

Mr. Jacops read the beginning of a proposed summary.

Mr. Rolph, *East African Railways and Harbours*. — I feel that it is necessary to differentiate between the welding of existing track and the laying of new long welded track.

Mr. Dean. — We have not quite finished. « ... transport these to their destination by suitable rakes, and... » I think we should have a more general term « joint » there because there are other ways in which we connect them.

Mr. Josse (in French). — You mean

the welding ? Not the assembly ? The final welding ?

Mr. Crespo Mocorrea (in French). — It is not the same thing.

Mr. Jacobs. — No, fitted and bolted joints.

Here is the text suggested for Summary No. 8 :

« The method generally preferred for making L.W.R. is first of all to flash-butt weld in the shops the longest possible lengths of rail, transport these to their destination on suitable rakes, and join them together on the site by the most suitable method. For this latter, the most widely used method is thermit welding.

« The majority of the Administrations agree that the two welding processes cited above do not need any subsequent heat treatment. »

The President (in French). — No further comments, Gentlemen ?

— *Adopted.*

Mr. Jacobs. — *Summary No. 9 :*

9. The temperature considered best for the final tightening up of the L.W.R. is a few degrees higher than the average between the extreme temperatures of the year. If this optimum temperature is not reached at the time the work is carried out, it is recommended to free the stresses and regulate again the length of the rails as soon as the desired conditions are realised. Heating the rails in order to obtain the desired laying temperature artificially has been tried sporadically, but is not the general practice.

Mr. Feyrabend (in French). — I think the first sentence : « The temperature

considered the best for the final tightening up of L.W.R. is a few degrees higher than the average of the extreme annual temperature range. » somewhat too strict.

But the second sentence seems even more serious to me : « If this optimum temperature is not reached whilst the work is being done, it is recommended to proceed to free the stresses and re-regulate the length of the rails as soon as the desired conditions are obtained. »

In practice, if we consider what takes place on the site of work, this will mean re-regulating all the rails laid. This is rather a complicated operation.

We do not carry out any re-regulation of rails laid between 14 and 36°. Between 10 and 14° and between 36 and 40°, we have what I might call a more flexible range; we are busy examining if, with experience, the 14-36 range might be extended.

If you retain this summary, the Railways will not manage in practice to free the stresses before there are serious changes in the temperature, and will find themselves in an extremely tiresome position, for which there is fact no technical necessity.

This year in France we had a late spring and very hot weather; practically if the range must be so narrow as indicated by the text, nearly all rails would have to be freed and the Railways would never be able to do this. On the contrary, with a wider range, they found themselves in a much better situation.

Mr. Dunton. — The actual figures might create a difficulty, we say : « it is recommended ».

Mr. Jackson. — In America, at the average temperature.

Mr. Feyrabend (in French). — They are lucky. How many days a week can they lay them ?

Mr. Josse (in French). — Or per annum ?

Mr. Feyrabend (in French). — Is there never any rain or cloudy weather in the United States ?

Mr. Jacops (in French). — They generally lay them leaving regulating joints which are closed when the maximum temperature is reached.

Mr. Crespo Mocerrea (in French). — Not an easy matter.

Mr. Feyrabend (in French). — I have seen American notices giving instructions that the temperature when laying must be painted on the rails; so it does not look as though the temperature is always constant. This information is for the benefit of the foreman responsible for maintenance, to allow him later on to know the temperatures at which work may be done in the track.

Mr. Jackson. — They don't do it at temperatures like they do in France, because they have the ordinary fishplate joint.

Mr. Jacops. — In fact, the Americans have no expansion devices.

Mr. Feyrabend (in French). — I know.

Mr. Jacops (in French). — In their case there is no question of freeing the stresses.

Mr. Feyrabend (in French). — I agree with you, I just made this comment to answer Mr. JACKSON when he spoke of the constant temperature in the United States.

Mr. Dunton. — The text as stated says : « it is recommended ». Is it possible we can do something with these words. « It is recommended wherever possible... » « It is of advantage... » Some slightly less strong words. The principle is right but don't make it too hard in practice.

Mr. Jacops. — Where would you like to introduce these words ?

Mr. Dunton. — Where you have the words : « it is recommended ». « It is generally desirable where practicable », or some such softer phrase. I think perhaps we might do it by putting it in a little earlier in the previous sentence. Could we say : « if this optimum temperature is... » What we want to say is if we do not get anywhere near it we must do something. It is too precise. If the temperature is at some distance from what it should be then we recommend it.

Mr. Jacops. — Do you consider it is advisable to release the stresses ?

Mr. Dunton. — In theory, we always do. In practice we let a few degrees either side.

Mr. Feyrabend (in French). — No, I do not agree.

Mr. DUNTON has just raised the point — and we were in complete agreement about this — of internal stresses which may be harmful; I do not think that thermal stresses can be included in these. He alluded to the question of accidental deformation, the need to clean the ballast, etc. it could even be said that long rails theoretically do not creep. In fact, there may be some which creep; on these points I agree with Mr. DUNTON, but I consider that thermal stresses, in the range I spoke of just now, are of no importance.

Mr. Jacops (in French). — Do you think, Gentlemen, that we might therefore come somewhat closer to the French thesis by saying: « The temperature considered to be the best... »

Mr. Josse (in French). — We should speak of the temperature range.

Mr. Jacops (in French). — « ... for the final tightening up... » Could we not say rather: « The temperature considered the best for *laying* long rails lies... »

Mr. Feyrabend (in French). — « ... to carry out... » was not bad.

Mr. Legrand (in French). — I suggest we keep the first sentence of this paragraph.

Mr. Feyrabend (in French). — We could use a less strong expression than « the best ».

Mr. Legrand (in French). — « The temperature considered to be the *most favourable*... »

The second sentence will be as follows: « If the temperature *at the time of laying differs considerably*... » or: « *at the time of tightening up* » ? — *from this optimum temperature*... »

Mr. Feyrabend (in French). — We must find some word to replace « best ».

Mr. Josse (in French). — It depends. In our case, it is a temperature considerably higher than the average temperature; in countries where the temperature is never low, the problem is quite different.

As this is rather a difficult question, Mr. President, I suggest we postpone further discussion of it till the next meeting.

Mr. Feyrabend (in French). — I agree.

The President (in French). — If you agree, Gentlemen, we will return to this point and to the remaining summaries at our next meeting. (*Agreed.*)

— The meeting ended at 12.50 p.m.

Meeting of the 6th October 1958.

PRESIDENT : Mr. F. PEREZ VILLAMIL.

— The meeting began at 9.30 a.m.

The President (in French). — Gentlemen, I will first ask you to agree the minutes of our last meeting.

Mr. Jackson. — Summary No. 3 in the Journal, the last sentence does not make sense. The whole of this portion of the Summary really deals with the

variation in minimum radius, and I feel that we have not emphasised sufficiently that any variation in radius is due to the variation in the annual temperatures and I would propose that we alter the last part of the Summary. « Where the annual variable temperatures are considerable most Administrations restrict the use of long welded rails to flat curves. The minimum radius permitted being from 500/800 m depending on the type of sleeper used. In a few exceptional cases where the temperature variation is insignificant, it has been possible to use long welded rails in curves of 200 m or even less. »

Mr. Jacobs. — There is therefore the question of altering Summary No. 3, which was worded as follows during our last meeting :

« 3. From the theoretical point of view, there are no limits to the length of L. W. R., for this reason the determination of the actual continuous length the most suitable in practice is based on practical considerations. These have not been selected identically by the different Administrations.

« Certain Railways fix this length simply according to operating requirements (insulated joints, track equipment, etc.), whereas others consider that it is not desirable to exceed a length of 800 to 1 000 m (2 600' to 3 200'),

« Most Administrations have used long welded rails when the alignment did not include any curves of a radius less than 500 to 800 m according to the type of sleeper. The minimum radius varies according to the regions and the track materials. In particularly favourable

conditions certain Administrations have used long welded rails even in curves of a radius of less than 200 m. », and to say in the last paragraph :

« In regions where the annual temperature variations are considerable, most of the Administrations restrict the use of long rails to curves of relatively large radius, the minimum radius authorised varying from 500 to 800 m according to the type of sleeper. In certain exceptional cases, where the temperature variations are insignificant, it has been possible to use L.W.R. of curves of radii of less than 200 m. »

Mr. Feyrabend (in French). — In this new text, the word « *considerable* » seems rather too strong to me. It would be better to say : « ... where the annual temperature variations are *marked*... »

Mr. Unal (in French). — Or « *important* ».

Mr. Josse (in French). — And the word « *insignificant* » is also too strong — in the opposite direction.

Mr. Feyrabend (in French). — Let us say « *appreciable*. »

Mr. Jacobs. — « *Considerable* » at the beginning is too strong and « *insignificant* » towards the end is too weak.

Mr. Jackson. — I feel that the only reason you can use these small radii is because the temperature variation is so small. No indication is given here of what the variable condition is, it might be particularly favourable condition of track.

Mr. Feyrabend (in French). — In temperate countries, 90° is normal; it is not exceptional.

Mr. Jacops (in French). — Let us say that it just skirts the maximum.

Gentlemen, I would like to know, if apart from this question of terminology, you are agreed on the text as a whole?

Mr. Feyrabend (in French). — In essence, yes. It avoids the risks there might be in the first text; on the form, no.

Mr. Jusseau (in French). — May I remind you that during the last meeting, I wished we could suppress the word « authorised » which was suggested. In fact, someone said this might take us to prison! I would prefer to say : the radius *used* or *applied* but not *authorised*. Authorised by whom?

Mr. Feyrabend (in French). — Gentlemen, is it necessary to alter the whole text, which satisfied everyone, in order to include this suggestion, which is a judicious one I agree, but it would be taken into account by changing two or three words in the first part of the sentence, without changing all the rest, which has been discussed at length, and which, I repeat, was unanimously agreed.

In the French text, it says « La plus grande partie des Administrations a équipé... » As it is not a question of the past only, but a continuous action, we could say : « ... *are equipping*... etc. »

Further on I would like to say « ... are equipping their lines with L.W.R. on sections where the radius of the curve is not less than 500 m. »

This would ease our mind, and this modification would not oblige us to go over the whole text again and all the words which already *have* been carefully weighed and considered.

Mr. Jacops (in French). — Do you not think, Mr. FEYRABEND, that it is more or less the same thing? The section may be 10 km and the curve 500 m.

Mr. Feyrabend (in French). — If you want to be precise : *curves whose radius is not less than 500 or 800 m ... »*

Mr. Josse (in French). — I do not think the old wording gave rise to any confusion.

Mr. Jacops (in French). — Perhaps the English text is not so clear as the French text.

Mr. Josse (in French). — The French text is clear.

Mr. Feyrabend. (in French). — Perhaps it is not necessary to modify it. In our case, there is no ambiguity; my suggestion was merely intended to satisfy Mr. JACKSON. In the French text, it is sufficient to alter « a équipé » to « équipent ».

Mr. Alexander. — Mr. CHAIRMAN, I would like to suggest we use the word « limited » instead of « insignificant ».

Mr. Jackson. — I think that the only reason for which these small radii are admissible is that the variation of temperatures is low. The summary does not state what is this favourable condition :

it might be a particular favourable condition of the track.

Mr. Jacops. — There is a statement about the state of the track and the temperature.

Mr. Feyrabend (in French). — This is not under discussion; it is a question of the temperature and equipment. Our colleagues from Africa enjoy two favourable factors: the temperature on the one hand, the equipment used on the other.

Mr. Josse (in French). — The German Railways, which do not have favourable temperature conditions, have made trials on small radius curves; therefore it is not a question of temperature. I do not think the old wording should cause any anxiety.

Mr. Jacops (in French). — You would not make any alteration in the last paragraph?

Mr. Josse (in French). — Definitely not.

Mr. Jacops (in French). — You consider that with this wording, it goes without saying that it is when temperature conditions and the constitution of the track are favourable.

Mr. Josse (in French). — It is concerned with favourable conditions, not only of temperature but of everything else.

Mr. Jacops (in French). — Including the ballast?

Mr. Josse (in French). — Yes, the equipment of the track, the lateral resistance, etc.

Mr. Jackson. — The most important thing is temperature, otherwise it would be impossible with a big range in temperature to use these small curves. I think that is agreed by everyone.

Mr. Feyrabend (in French). — I have heard what Mr. SCHRAMM had to say about a radius of 200 m when there are in fact considerable temperature changes; consequently the scope of this paragraph should not be restricted by the word « temperature ».

Dr.-Ing. Schramm. — 30° minimum and the highest temperature of the rails in Germany is about 60°, but in general the difference of temperature is not so high.

Mr. Jacops. — What variations have you had during this period?

Dr.-Ing. Schramm replied in German.

Mr. Jacops translated what he said into French: Dr. SCHRAMM says that he has carried out tests on a track of less than 250 m radius and that there were temperature variations of — 15° to + 60° which is a considerable range. He thinks it would be wrong to state that particularly favourable conditions include a restricted temperature range.

Dr.-Ing. Schramm. — But we have a very good fastening.

Mr. Jacops. — That is one of the favourable conditions.

Dr.-Ing. Schramm. — Yes, ballast and so on.

Mr. Feyrabend (in French). — This confirms what has already been said.

Mr. Jacops (in French). — It is your opinion that this paragraph should be retained? (*Agreed.*) *He continued in English:* The French Delegates wish to maintain the text as it is. Would it be advisable to alter the English text?

Mr. Dean. — Would it not be simplest, looking at the English text, for us to simply add right at the beginning « Up to the present », and then in the second sentence instead of saying « varies according to the regions and the track materials », say « according to the temperature range ». Then, I think it can stand.

Mr. Glendinning. — It is not a question of modifying the English text, in other words it is not a matter of the translation, it is a technical question.

Mr. Dean. — A few general words put in right at the beginning, such as « Up to the present ». In other words, we are experimenting, and may want to alter it later on. I think now we should say: « Up to the present most Administrations, etc. », and then in the second sentence: « The minimum radius varies according to the temperature range... »

Mr. Josse (in French). — The surface and the constitution of the track.

Mr. Feyrabend (in French). — The word « région » implies the temperature of these regions; it is simply a question of the way we take it. It makes the French text unnecessarily heavy; in my opinion, we should keep to the original text. If the translation of the expression into English does not correspond to the way it should be understood, we must find another.

Mr. Jacops (in French). — I think it is far from being a matter of the wording.

Mr. Josse (in French). — What about replacing the word « region » by « climate »?

Mr. Jacops. — « Climate » instead of « region ».

Mr. Vanbourdolle, *French National Railways* (in French). — We might say: « ... according to climatic conditions... »

Mr. Glendinning. — But this has nothing to do with Mr. JACKSON's remark.

Mr. Jackson. — Yes, that is not actually a fact, because you can put in long welded rails... (*Interruptions in French.*) I would suggest the following wording: « Up to the present most Administrations restrict their use of long welded rails to flat curves, the minimum radius permitted being from 500 to 800 m, depending on the type of sleeper used. »

Mr. Jacops. — Some of these Gentlemen are not in favour of the word « authorised » because it is a dangerous word for engineers to use.

Mr. Jackson. — What do you suggest then ?

Mr. Jacops. — The French speaking Delegates propose to say : « Most of the Administrations use long welded rails on straight sections and on curves when the radius of the latter is not less than 500 or 800 m according to the type of sleeper ».

He then continued in French : Another point has not been settled. We always get back to Mr. JACKSON's objection to the wording of the first sentence, from which it may result that if on a 20 km section there is a 300 m radius curve, it appears forbidden to lay L.W.R. throughout all this section.

Mr. Feyrabend (in French). — That will not do.

Mr. Jacops (in French). — To meet the English Delegates, could we not simply alter one word in the French text ?

Mr. Feyrabend (in French). — What do you suggest ?

Mr. Jacops (in French). — We might say : « The greater part of the Administrations equip the track *on curves with L.W.R. when the radius is not less than 500 or 800 m according to the type of sleepers...* »

Mr. Feyrabend (in French). — « The greater part of the Administrations equip the track *on the straight* and on curves with L.W.R. when the layout of the latter... »

Mr. Jacops (in French). — That applies solely to the curves.

Mr. Feyrabend (in French). — It is not made clear that it applies solely to curves. « The greater part of the Administrations equip the track with L.W.R. on straight sections and on curves when the layout of the latter... » — « the latter » refers directly to curves.

Mr. Unal (in French). — Agreed.

Mr. Feyrabend (in French). — Or : « ... on straight sections and on curves when the *radius of these is not less...* »

Mr. Crespo Mocerrea (in French). — « ... does not go below ... »

Mr. Jacops (in French). — We have already used these words in the last sentence, so it would be better to change it a bit. « ... is not lower than 500 or 800 m according to the type of sleepers. »

Mr. Crespo Mocerrea (in French). — This is not general.

Mr. Jacops (in French). — « The minimum radius varies according to *climatic conditions.* »

Mr. Feyrabend (in French). — It is the first sentence we are dealing with.

Mr. Dean. — Up to the present.

Mr. Glendinning. — At the beginning of the sentence.

Mr. Jacops (in French). — The English Delegates want to add : « up to the present. »

Mr. Feyrabend (in French). — With what object ? To restrict or extend the meaning ?

Mr. Jacops (in French). — Why do you want to say : « Up to the present » ?

Mr. Dean. — Because we might alter our views in the future.

Mr. Feyrabend (in French). — We are speaking of the present. If you spoke of the past, it sounds as though you had given the thing up. It must be in the present.

Mr. Jacops (in French). — Yes, we are speaking solely of the past and the present, so we can retain this sentence : « Most of the Administrations have used long welded rails on the straight and on curves when the radius of the latter is not less than 500 or 800 m according to the type of sleepers used. »

To meet Mr. DEAN do you wish to add : « at the present time » ?

Mr. Feyrabend (in French). — That gives a restricted meaning which is not right. It results from all the summaries we are arriving at progressively — if I may be excused from intervening again — that in point of fact in the case of L.W.R. it makes little difference whether it is standard gauge track or not. It is the principle which should be conveyed by our summaries; and any restrictive phrase would be harmful to this principle.

Mr. Jacops (in French). — Does everyone agree ?

Mr. Feyrabend (in French). — Would you please read the first part of this paragraph again ?

Mr. Jacops. — « The majority of the Administrations equip the track with L.W.R. on straight sections and on

curves when the radius of the latter is not less than 500 or 800 m according to the type of sleepers. The minimum radius varies according to climatic conditions and the constitution of the track. Under particularly favourable conditions, certain Railways go as low as radii of less than 200 m. »

Mr. Feyrabend (in French). — To avoid the confusion mentioned by Mr. JACKSON, we should say : « The greater part of the Administrations equip the track with L.W.R. on straight sections and on curves whose radius is not less than 500 or 800 m... »

Mr. Crespo Mocerrea (in French). — I agree.

Mr. Dunton. — In the *Daily Journal*, No. 4, the report of my remarks is so concise that it has no meaning. It says : « Mr. DUNTON considered there was a difference between standard and narrow gauge track. ». There is, of course, a difference in width. What I said was that « there is a difference in the strength of narrow and standard gauge track considered as a beam. »

Mr. Josse (in French). — The track cannot be considered to be like a beam.

Mr. Feyrabend (in French). — Technically, we are not agreed.

Mr. Unal (in French). — We note Mr. DUNTON's observation.

Mr. Feyrabend (in French). — We insist on replying to it!

Mr. Robert LÉVI insisted on the fact that there should not be any difference, even if the track merely consisted of one rail.

Mr. Jacops (in French). — We will modify Mr. DUNTON's intervention by stating that he considers there is however a difference in resistance between standard and narrow gauge track, considered as a beam.

The President (in French). — No other comments on Summary No. 3 ?

Mr. Jacops. — The text of Summary No. 3 will therefore be worded as follows :

« 3. From the theoretical point of view, there are no limits to the length of L.W.R., for this reason the determination of the actual continuous length the most suitable in practice is based on practical considerations. These have not been judged in the same way by the different Administrations.

« Certain Railways fix this length simply in accordance with operating requirements (track equipment, such as insulated joints and switches and crossings), whereas others consider that it is not desirable to exceed a length of 800 to 1 000 m.

« The majority of Railways use long welded rails in straight track and in curves of which the radius is not less than 500 to 800 metres, according to the type of sleepers used. The minimum radius varies in accordance with climatic conditions and the materials used in the track. In particularly favourable conditions certain Railways come down to curves of a radius less than 200 metres. »

— *Adopted.*

Mr. Jacops. — Regarding Summary No. 8, the Meeting of October 2nd approved the following text :

« 8. The method generally preferred for making L.W.R. is first of all to flash-butt weld in the shops the longest possible lengths of rail, transport these to their destination on suitable rakes, and join them together on the site by the most suitable method. For this latter, the most widely used method is thermit welding. The majority of the Administrations agree that the two welding processes cited above do not need any subsequent heat treatment. »

Mr. Feyrabend (in French). — Mr. President, we discussed at length, in connection with this summary, the question of electric welding. To correspond with conditions on certain Railways, we said that « the process *generally* preferred consists... » because in fact certain Railways cannot make a welding plant pay for itself. I think that in the text the word *generally* has a more technical than economic meaning, so would it not be better to say : « ... the process preferred *wherever possible*... » ?

I think that this will meet the wishes of the Delegates who asked for this modification.

Mr. Jacops (in French). — However, the word « preferred » is not absolute. Mr. JOSSE said so and this is explained in the minutes.

Mr. Feyrabend (in French). — « Generally » has a restrictive meaning. I prefer : « ... the method preferred *wherever possible*... » This corresponds to the position reported; Delegates told us, in fact, that if they were able to use an electric welding plant, they would do so.

Mr. Josse (in French). — Yes.

Mr. Feyrabend (in French). — This fact must be stressed.

Mr. Nicolas (in French). — I am not sure that the word « generally » is not preferable; it expresses a statement whereas your text would be inciting to obtain such plant. « Wherever possible » does not mean very much — it is always possible.

Mr. Unal (in French). — « ... wherever economically possible... » ?

Mr. Nicolas (in French). — « ... generally... » gives the present position; therefore I prefer « generally ».

Mr. Feyrabend (in French). — But the term « generally » diminishes the force of the word « preferred » which has a technical character; now from the technical point of view, no one is disputing this preference; it is a preference of opportunity rather than technique.

We might say : « ... wherever the number of welds makes it possible to install a machine... » but in this case the sentence becomes impossibly long.

Mr. Jacops (in French). — Are there any other comments on the minutes ?

Only the first sentence will be slightly modified therefore, and will read as follows : « To make L.W.R., the method preferred, wherever this is possible, is to flash butt weld... etc. »

This modification of the first sentence was approved, and the text of Summary No.8 therefore becomes :

« 8. The method preferred where possible for making L.W.R. is to flash-butt weld in the shops the longest lengths of rail that can be welded, transport these to their destination on suitable rakes, and join them together on the site by the most suitable method. For the latter most widely used method is thermit welding.

« The majority of Administrations agree that the two welding processes cited above do not need any subsequent heat treatment. »

Mr. Nicolas (in French). — Mr. President, there is one question which has not been discussed, and that is the ballast which is mentioned in Summary No. 7, the following text of which was approved at our last meeting :

« The ballast should consist of hard, sharp stones between 25 and 60 mm in size.

« Wide ballast profiles must be maintained, the space between sleepers should be well filled in and an adequate shoulder provided. »

Up to the present, we have adopted non-restrictive summaries, leaving things open for the future; in the case of the ballast, on the contrary, we state that it should be of a certain size, of hard, sharp stone.

This somewhat contradicts the fact that the stability of the welded track depends, in one sense, on characteristics of which the ballast is only one condition, in other words the temperature. The materials used for the track are just as important as the ballast, so that the summary adopted amounts to saying that if a Railway has no hard stone which can

be broken up to between 25 and 60 mm in size, it can never lay welded rails...

This conclusion seems rather exaggerated to me. It would be better to say that the ballast should offer sufficient lateral resistance, the climatic conditions and the constitution of the track being taken into account. This will not prevent some Railways carrying out trials, even if they have no hard ballast.

Mr. Jacops (in French). — I think experiments are never forbidden, but I feel that our experience is sufficient to back up the statement that ballast consisting of round gravel must not be used. I think most of the Railways will agree that this is so.

Mr. Nicolas (in French). — It does not say that those Railways who only have gravel cannot successfully attempt to lay their track by welding the rails. It would be better to say that the ballast should offer adequate lateral resistance in view of the fact... etc.

Mr. Feyrabend (in French). — We might simply say that « hard, sharp stone ballast between 25 and 65 mm in size *results in particularly favourable conditions* » or : « *offers conditions...* » It is true that the word « stone... »

Mr. Jacops (in French). — What about saying : « *elements* » ?

Mr. Feyrabend (in French). — That is right : *elements*.

Mr. Jacops (in French). — Mr. FEYRABEND wishes to say in Summary No. 7 :

« The ballast should consist of hard, sharp elements, between 25 and 60 mm in size which creates particularly favourable conditions for long welded rails. »

Mr. Dean commented upon the wording of the English text of this summary.

Mr. Jacops (in French). — In the French version we must therefore say : « Il convient d'établir un profil de ballast suffisamment large, de garnir convenablement les boîtes et de *maintenir correctement* les banquettes. »

During our meeting of the 2nd October, Mr. FEYRABEND pointed out that the ballast profile was always right when made, but it was a question of maintaining it.

Mr. Josse (in French). — Why make any change in the text ? We wanted to say that the ballast profile generally adopted for ordinary track can also be used for welded track; this was also what we meant when we used the word « *maintenir* ».

Mr. Unal (in French). — The phrase means exactly the same in English.

Mr. Jacops (in French). — I do not think the meaning is the same; « *maintenir* » means taking care that during the work the ballast is not nibbled away and not replaced.

Mr. Feyrabend (in French). — I see what you mean. When I made my previous comment, as Mr. JACOBS has reminded you, I understood that we were saying that the ballast was always like this, but that it was necessary to maintain it so

afterwards. You raised the objection of unduly wide profiles; I reported that to start with the profiles were correct, and the problem only arose afterwards.

Mr. Dunton suggested an alternative for the English text.

Mr. Dean supported his English colleague.

Mr. Jacops. — By « full profile » you mean the ballast between the rails and the sleepers ?

Mr. Dunton. — It is necessary that the profile should not only be wide, that the bed between the sleepers should be full. A wide ballast profile might still have a low through.

Mr. Jacops (in French). — Messrs. DUNTON and DEAN therefore suggest we say : « *It is necessary to make and to maintain a wide and full ballast profile.* » This is a question of the translation.

Mr. Unal (in French). — « Full » ? There is no point...

Mr. Jacops (in French). — It is a question of the way the spaces between sleepers are filled.

Mr. Crespo Mocorrea (in French). — Why alter the text ? It is not worth it.

Mr. Jacops (in French). — It is simply a question of the wording. Mr. DUNTON has pointed out that on the one hand the ballast profile must be sufficiently wide and on the other hand that it must

be at the proper level compared with the top of the sleepers and kept level. In English there is no word that will translate « boîtes ».

Mr. Feyrabend (in French). — The French text says all that is necessary in a few words, to make it quite clear.

Mr. Jacops (in French). — You know enough English Mr. FEYRABEND to tell us if you agree that the English text suggested by Mr. DUNTON should be adopted. Do you think this is the equivalent of the French text ? We are keeping the French text as it is.

Mr. Feyrabend (in French). — Agreed.

Mr. Jacops read the French text once more. (*Adopted.*)

The English text amended by the Secretary was worded as follows :

« 7. The ballast should consist of hard, sharp elements of between 25 and 60 mm in size.

« Wide and full ballast profiles must be provided and maintained. »

The President (in French). — We will now return to the discussions of Summary No. 9 which were interrupted at our last meeting.

Mr. Jacops (in French). — Here Gentlemen, is Summary No. 9 as submitted for your approval; I will endeavour to give a brief summary of the discussions to which this text gave rise.

« 9. The temperature considered to be the best for the final tightening up of

L.W.R. is a few degrees higher than the average between the extreme annual temperature range. If this optimum temperature is not reached when the work is being done, it is recommended that the stresses be freed and the length of the rails regulated again as soon as the requisite conditions are realised. The heating of the rails for the purpose of obtaining the desired temperature for laying artificially has been tried sporadically but is not the general practice. »

This immediately called forth a comment by Mr. FEYRABEND, who considered that the text was too strict. He told us that in France laying took place over a temperature range of between 14 and 36°, but that it would be possible to extend this to a range between 10 and 40° provided certain precautions were taken.

We then heard comments by Messrs. JACKSON and DUNTON, after which Mr. LEGRAND suggested that the first phrase should be retained; it was suggested that mention should be made of the temperature which theoretically was considered the best.

Finally, Mr. LEGRAND suggested saying, in the second sentence of the first paragraph : « If the temperature at the time the fastenings are tightened up is considerably different from this optimum temperature... »

It was at this point that the discussions were broken off.

Mr. Feyrabend (in French). — I think that the text of this Summary No. 9 corresponds to the ideas which were held when long rails began to be laid; it no longer corresponds to the opinions of those Administrations who have laid a lot of long rails.

The temperature considered to be the best, as stated at the beginning of the paragraph, does not exactly correspond with reality since the rails can be laid over a very wide temperature range.

The text should be completely revised, starting to begin with this temperature range. The first sentence relating to the temperature considered to be the best corresponds a little to the idea expressed by Mr. JACKSON when he told us that the Americans continue the work at the same temperature as that at which the rails were first laid. This seems to me a somewhat theoretical point of view, at least from the information which I have collected directly from Americans themselves. Just like Europeans, they lay the rails when they can. In fact, the American foremen told me that they write the temperature at which the tightening up took place on the rails.

In view of these remarks, we should revise the wording of this summary to make it correspond to the lengthy experience of certain Railways and to the idea I expressed just now, namely that in practice though long rails may involve certain precautions compared with standard rails, they do not call for any such precautions as would make it impossible ever to lay long rails.

Mr. Josse (in French). — I would like to add to what Mr. FEYRABEND has just said that first of all the idea of the optimum temperature must be replaced by the idea of a temperature range.

In addition, it would be as well to make it clear that this need not necessarily exactly coincide with the mean temperature; it is advantageous, especially

as far as future *maintenance* is required, to set it a little higher every time. To take these two factors into account, here is the text I suggest for Summary No. 9 :

« The final tightening up of long welded rails must be realised within a temperature range, which from the experience of several Railways, can be a fairly wide one. The middle of this range is equal to or higher than the mean annual temperatures of the rail. If when laying the rail it was not possible to tighten up the fastenings within the desired temperature range, it is recommended to carry out freeing of the stresses followed by the final tightening up as soon as the necessary conditions are realised. »

In the last sentence, I have left out « regulate the length of the rails » because in fact it is de-stressing and not regulation of the length of the rails that takes place.

Mr. Jacops (in French). — Perhaps...

Mr. Josse (in French). — It is the freeing of the stresses; the modification in the length is the consequence.

Mr. Cividalli (in French). — I think it is necessary to indicate with a certain approximation the value of the range certain Administrations allow; to say it can be a wide range, is too vague.

Mr. Crespo Mocorrea (in French). — It must in fact be defined.

Mr. Feyrabend (in French). — I have no objection.

Mr. Jacops (in French). — In view of the English translation which I have just heard,

I think it would be advisable to alter not the meaning but the form of this text; should we not state that the temperature range can be « *largement* » instead of « *notablement* » open ? In the English text it says : *rather*.

Mr. Josse (in French). — I think « *largement* » is going too far.

Mr. Jacops (in French). — Would you prefer : « *relativement ouvert* » ?

Mr. Feyrabend (in French). — To my mind it should be « *largement ouvert*... »

Mr. Cividalli (in French). — What does « *largement ouvert* » mean ? Some think it means 2°, others 10 or 20°. To my mind there should be some indication.

Mr. Jacops (in French). — From the reports, the range covers 5° for the German Railways...

Mr. Feyrabend (in French). — Plus or minus 5°, tolerance 3 ?

Mr. Josse (in French). — For the French Railways, it is the maximum : plus or minus 12°.

Mr. Feyrabend (in French). — At the present time.

Mr. Josse (in French). — Let us say the range is from 10 to 25°.

Mr. Dunton. — I think we should all agree it is desirable to lay long rails as near as possible to mean temperature, but that for practical reasons it is necessary

to allow tolerances in temperatures which can be regarded as satisfactory. It would be difficult for us to agree the exact range of tolerances to allow in general practice.

Mr. Feyrabend (in French). — No, it is not desirable; when 800 km a year are laid, it is not « desirable »; they would not be laid.

Mr. Dunton. — Never. Exactly.

Mr. Jacops (in French). — Here is Mr. JOSSE's text slightly altered by Mr. FEYRABEND :

« The final tightening of L.W.R. should be made within a given temperature range which, from the experience of several Railways, may be rather wide. The mean of this range is equal to or higher than the average... »

Could we not say : « lies at or slightly above the average » ?

Mr. Feyrabend (in French). — I agree, I have no objection.

Mr. Jacops (in French). — To return to this sentence : « The mean of this range lies at the average annual temperature range or slightly above it. »

Mr. Josse (in French). — « Above » but not necessarily « slightly above it ». In our case, the welding range is 30-45°, the extreme temperatures being 10 and 55°.

Mr. Jacops (in French). — But you said : « The mean of this range is *equal* to or *higher*... »

Shall we say : « The mean of this range lies at the average of the annual temperature range or above it. If at the time of laying the track, the fastenings have been tightened within the desired temperature range... » we ought to say : « have not been tightened ? » (*Agreed.*) Consequently : « If at the time of laying the track the fastenings have not been tightened within the desired temperature range, it is recommended to release the stresses, followed by the final tightening up, as soon as the required conditions are fulfilled. »

Mr. Feyrabend (in French). — I think the sentence should be altered a little. In reality, the fastenings are tightened up outside the desired temperature range, whereas the English text states that they are not tightened up outside this range. We should say : « If at the time of laying the track, the fastenings *were tightened up outside the desired temperature range*... »

Mr. Jacops. — Mr. SCHRAMM, may I ask what your temperature range is ?

Dr.-Ing. Schramm. — We weld at a rail temperature of between 20 and 25° C. If necessary we heat the rail with a propan gas torch and thus are able to weld at any ambient temperature.

Mr. Feyrabend (in French). — Mr. President, I would like to ask Mr. SCHRAMM how many days he has to be there, after laying the track, if he insists on such a strict temperature range ? How does he lay the track during this transitory period ?

Mr. Jacops (in French). — In Germany, the rails are heated.

Mr. Feyrabend (in French). — That means having the right equipment. How long does Mr. SCHRAMM make his rails ?

Mr. Jacops (in French). — Dr. SCHRAMM how long do you make the rails before taking them to the site where they are then welded ?

Dr.-Ing. Schramm. — Our rails are 120 m long.

Mr. Jacops (in French). — 120 m.

Mr. Feyrabend (in French). — How many welded rails does the D.B. lay a year ?

Dr.-Ing. Schramm. — We weld now about 2 000 km per year. At the end of this year, we will have a total of about 12 000 km of welded track.

Mr. Feyrabend (in French). — Taking it that the D.B. work every day of the year, that means 60 rails to be heated every day. You must need a lot of equipment.

Dr.-Ing. Schramm. — Yes, but we have sometimes the right temperature in the summer and there is no necessity to warm the rails, and so we work like that from March to October; during these months it is generally warm and it is not necessary to warm the rails. It is better when it is not necessary to warm the rails.

Mr. Feyrabend (in French). — It says at the end of the original text of this Summary No. 9 : « Heating the rails in order to obtain the desired laying temperature artificially has been tried spora-

dically, but is not the general practice. » It would appear therefore that heating the rails is still in the trial period ?

Mr. Jacops. — If the heating of the rails is now the general practice, do you always do it ?

Dr.-Ing. Schramm. — Only when it is necessary because of the temperature.

Mr. Jacops (in French). — I must point out that in Mr. JOSSE's suggestion, this point of artificially heating the rails has not been retained.

Mr. Josse (in French). — According to the reports, there is only one Administration that mentions it, so that it is not a general practice.

Mr. Feyrabend (in French). — In the original text, it speaks of trials of heating, not of heating as a general practice.

Mr. Crespo Mocerrea (in French). — The Austrian Railways are also going to make use of this method.

Mr. Josse (in French). — They have chosen the strictest temperature range; it might be said that one is the consequence of the other.

Mr. Feyrabend (in French). — Agreed. I don't think it matters.

I would like to return to the third sentence of the text proposed by Mr. JOSSE. The English text might give rise to difficulties in this respect if it is not made quite clear that the tightening up of the fastenings took place outside the desired temperature range.

Mr. Jacops (in French). — It might be considered that the first tightening up is not the final one.

Mr. Feyrabend (in French). — You sometimes have to wait six months; so the tightening up must be the final one, if the trains are to run over them at full speed.

Mr. Jacops (in French). — « The final tightening up of L.W.R. should take place within a given temperature range, which from the experience of several Railways, may be a fairly wide one. »

Here we must consider Mr. CIVIDALLI's remark, whether some indication of the range ought not to be given ?

Mr. Feyrabend (in French). — I suggest 24°.

Mr. Crespo Mocorrea (in French). — Plus or minus 12°.

Mr. Feyrabend (in French). — It is a question of the gap.

Mr. Josse (in French). — From the reports, in the Cameroons, you can take the annual variation as 35°.

Mr. Nicolas (in French). — We do not use 35°. We could be more precise and say after the words (widely open) put in parenthesis « (at the present time from 10 to 25°) ».

Mr. Jacops (in French). — We cannot give any absolute limits; the temperature extremes can differ according to climatic conditions.

Mr. Feyrabend (in French). — So that the mean is different.

Mr. Jacops (in French). — It varies.

Mr. Legrand (in French). — It is a matter of defining the mean.

Mr. Jacops (in French). — Shall we say, in parenthesis : « (of the order of 10 to 25° at the present time) ».

Mr. Josse (in French). — Let us say : « Up to 25° ».

Mr. Feyrabend (in French). — Just so : « (Up to 25°) ».

Mr. Jacops (in French). — Agreed, since 25° is a certainty.

This will give us the following text for the second paragraph :

« The mean of this range is found at the average of the extreme annual temperatures of the rail, or above it. »

Then :

« If, when laying the track, the fastenings have been tightened outside the desired temperature range, it is recommended to proceed to a release of the stresses, followed by the final tightening up as soon as the desired conditions are realised. »

Dr.-Ing. Schramm. — I think it must be done. The rail without tension.

Mr. Jacops. — It is called de-stressing.

Mr. Dunton. — Did not Mr. FEYRABEND mention maximum temperature ? I

agree within a temperature range which should not be too restricted.

Mr. Jacops. — Must we say up to 25° ?

Mr. Dunton. — It is too much.

Mr. Feyrabend (in French). — In fact, it is not too much. We do so in France throughout the whole year.

Mr. Jacops. — In France, yes. It is 24°.

Does everyone agree about this wording ? I will read it through once more :

« 9. The final tightening of L.W.R. should be made within a pre-determined temperature range, which according to the experience of most Railways may be rather wide (up to 25° centigrade).

« The mean of this range should equal or exceed the mean annual temperature of the rail.

« If at the time of laying the track the fastenings have been tightened outside the desired range of temperatures, it is recommended that de-stressing should be carried out, followed by a new tightening, when the required conditions are fulfilled. »

— *Adopted.*

Mr. Jacops. — We now go on to *Summary No. 10* :

10. The spacing of the sleepers and the method of putting new rails into service — in particular, speed restrictions on newly laid rails — are the same as those laid down for lines of similar category with relatively short rails.

Mr. Alexander. — Mr. Chairman, is it wise to keep the same spacing of sleepers ?

Surely we have varying centres of sleepers some near the joints because they are the centre of increased stresses.

Mr. Jacops. — That is not the meaning of this sentence : it is a question of the average distance between sleepers.

(*Continuing in French*) : I think Mr. ALEXANDER's comment is based on a misunderstanding; in effect, what he is saying is that when short rails are used, it is usual to bring the sleepers closer together at the joints; when the rails are welded he is wondering whether the same spacing should be used slightly varied. The meaning of the text of the summary obviously refers to standard distances uniformly used throughout.

Mr. Feyrabend (in French). — Average.

Mr. Dean. — I think Mr. ALEXANDER has raised a very important point. I am not sure in the English text whether we are talking about the same thing at all. We are not concerned with spacing relative to the number of sleepers, but the fact of laying sleepers and the method of putting new rails into service, in particular, speed restrictions. I don't know what it means ?

Mr. Crespo Mocorrea (in French). — We must add : « standard ».

Mr. Feyrabend (in French). — « Average ». In French, we must say : « le *travelage* » which means the number of sleepers per kilometre.

Mr. Crespo Mocorrea (in French). — Yes, « *travelage* » is better.

Mr. Jacops (in French). — In this summary, two different things are dealt with at one and the same time, the geometrical question if I may call it so and on the other hand the technical aspect of laying the rails, and in particular speed restrictions. It is obvious that an 800 m long rail is not laid in the same way as a 24 m long one.

Mr. Feyrabend (in French). — I think the sentence should be cut in two. In the case of the working method, we could use the word « travelage » and then say that speed restrictions over newly laid rails are the same as those laid down, etc. The method of laying is not the same for 800 as for 24 or 18 m.

Mr. Jacops translated this into English and suggested a wording.

Mr. Dean. — Not spacing : laying. Spacing is quite different in England for short and long rails. It has nothing to do with spacing as we understand spacing.

Mr. Jacops. — I think it is the contrary on the Continent.

Mr. Dunton. — They are two different questions in the summary. Perhaps we could deal with them separately.

Mr. Alexander. — Is it intended to use the average number of sleepers per unit of length ?

Mr. Jacops. — On the Continent, the number of sleepers per kilometre is generally the same in both cases. Mr. DUNTON has said that this is not

the case in Great Britain. One part of the summary deals with the work and the other with the geometrical conditions. In reality, these are two different questions. I think it would be better, as Mr. DUNTON has suggested, to separate the two things.

Mr. Feyrabend (in French). — I quite agree with the remark made by the Representative of the British Railways.

Mr. Crespo Mocerrea (in French). — This refers to Summary No. 12 of my report.

Mr. Feyrabend (in French). — In fact, there should be two summaries; we might include this part of the text in Summary No. 9 or Summary No. 12.

Mr. Dean. — Can we separate them ? May I suggest all we need in this question relative to its real subject matter is :

« Speed restrictions on newly laid track are the same with long welded rails as for lines with short rails. »

Mr. Feyrabend (in French). — The text of Mr. CRESPO MOCORREA's Summary No. 12 is perfect; it should be left as it is.

Mr. Jacops. — If you agree, we could take Summary No. 12 of Mr. CRESPO's Report instead of Summary No. 10 of the *Special Report*. Here is the text :

« The maximum speeds allowed on lines laid with L.W.R. are the same as those allowed on lines laid with standard length rails.

« Likewise the speed restrictions on newly laid L.W.R. are similar to those

laid down for newly laid classic type lines. »

To sum up, the two questions have been combined, but I agree to separate them.

Mr. Feyrabend (in French). — The point to which you have referred comes in No. 6 which deals with the types of sleeper and sleeper spacing.

Mr. Jacops (in French). — Can we take it that the text of Summary No. 12 of Mr. CRESPO's Report will replace the text of Summary No. 10 of the *Special Report* ?

Mr. Feyrabend (in French). — We should revise Summary No. 6.

Mr. Jacops. — Here is the text of the first sentence :

« 6. Although the weight of concrete sleepers makes them more suitable for use in tracks laid with L.W.R., such rails can well be laid with complete safety on wooden or metal sleepers. »

Mr. Feyrabend (in French). — In Mr. CRESPO's Summary No. 10 there is a rather longer sentence which meets the case very well : « The same sleeper spacing is generally used with all types of sleeper, and they are laid on the same kind of ballast as that used on lines laid with standard length rails. »

Mr. Jacops (in French). — Do you want to add this to Summary No. 6 ?

Mr. Feyrabend (in French). — We could say : « Although the weight of concrete sleepers makes them particularly

suitable for use on track laid with L.W.R., these can also be laid with complete safety on wooden or metal sleepers. The sleeper spacing used is the same as on track laid with standard rails. »

Mr. Nicolas (in French). — Could this not lead to confusion ?

Mr. Vaubourdolle (in French). — The number of sleepers per kilometre is the same.

Mr. Feyrabend (in French). — The number of sleepers is the same as in track with standard rails.

Mr. Jacops (in French). — We could add to Summary No. 6 at the end of the first sentence : « ... wooden or metal sleepers » a sentence saying : « The number of sleepers per kilometre is generally the same as on a line laid with standard rails. »

Mr. Dean. — No, we cannot accept that in Great Britain.

Mr. Jacops (in French). — In England, this is not the case.

Mr. Feyrabend (in French). — This is a more serious technical question. Apart from England, do any other Administrations use this method ? What does the D.B. which makes such an extensive use of L.W.R. do ? Is the number of sleepers per kilometre the same ?

Dr.-Ing. Schramm (in German). — It is the same.

Mr. Jacops (in French). — In Belgium also. And on your Railways, Mr. JOSSE ?

Mr. Josse (in French). — It is the same.

Mr. Alexander. — In your case the number of sleepers used is the same. It should be the same; the total number is the same but the spacing is quite different. The sleepers are closer together with short rails.

Mr. Jacops. — It does not make much difference having the sleepers so close.

Mr. Alexander. — If you are laying new track...

Mr. Dunton. — I think we must agree it is general to use the same spacing, the same number per mile.

Mr. Dean. — I do not agree that.

Mr. Dunton. — The difficulty arises because we use less sleepers per mile with short track than with long welded track. In some cases, but not always, we have increased the number of sleepers for long welded track.

Mr. Feyrabend (in French). — Yes, but normally you use very few sleepers.

Mr. Dunton. — It is impossible for us to agree that we do not have more sleepers under our long welded rails than for short rails, but we could agree that in many Administrations there is no difference. That is a fact.

Mr. Feyrabend (in French). — To take the comment made in English into

account we might say : « ... standard rails *of the same type*. » ?

Mr. Jacops (in French). — « ... *as on track of the same type*. » ?

Mr. Feyrabend (in French). — « ...*laid with standard rails of the same type*. »

Mr. Jacops (in French). — « ... of the same *section*. » ?

Mr. Feyrabend (in French). — The sleeper spacing is always greater with bull-headed rails than with Vignoles rails, and as when welded rails are used this means changing from bull-headed to Vignoles, we should say : « welded rails *of the same type*. »

Mr. Jacops (in French). — The number of sleepers per kilometre is generally the same on track laid with L.W.R. as on track laid with short rails.

Mr. Dean. — I think if you were to put in that the number of sleepers per kilometre is at least 1 500 then the number is the same for welded track as for ordinary length rails.

Mr. Jacops (in French). — Could we not say : « The number of sleepers per kilometre is generally the same on track with long welded rails as on equivalent track with standard rails » ?

Mr. Dunton. — Except where the normal standard is less than... (*Interruption in French.*)

Mr. Feyrabend (in French). — I understand what is meant, but I want to see the right wording.

Mr. Jacops (in French). — « On lines where the number of sleepers is at least 1 500 per kilometre, the number of sleepers remains the same. »

Mr. Feyrabend (in French). — That seems a bit long, but we could include this sentence in the minutes; that would meet Mr. DEAN.

Mr. Jacops (in French). — We could also say that L.W.R. require at least 1 500 sleepers per kilometre.

Mr. Feyrabend (in French). — It is a bit tiresome. Mr. DEAN's remark is interesting to include in the minutes, but the details could not be included in the text of a summary.

Mr. Jacops (in French). — It allows of exceptions.

Mr. Feyrabend (in French). — Agreed.

Mr. Jacops (first in English, then in French). — Does Mr. DUNTON wish us to say : « except when the normal sleeper spacing is less than... »

Mr. Feyrabend (in French). — Or : « *particularly light*. »

Mr. Crespo Mocerrea (in French). — In my opinion, the same sleeper spacing should be retained.

Mr. Jacops (in French). — Great Britain is an exception.

Mr. Vaubourdolle (in French). — You are altering the meaning of the sentence...

Mr. Feyrabend (in French). — « ... except when it is especially light... » ?

Mr. Josse (in French). — In that case it is no longer suitable for welded rails.

Mr. Feyrabend (in French). — To take Mr. JOSSE's comment into account we should say : « the same as that which would be used on track laid... » These, Gentlemen, are thinking of light sleepers, but when the track is renewed, they use heavier sleepers.

Mr. Jacops (in French). — Did you understand, Mr. DUNTON ?

Mr. Dean. — No.

Mr. Dunton. — I am not really clear.

Mr. Jacops. — Mr. JOSSE said that : we might state : « The number of sleepers per kilometre is the same as on track with ordinary rails except when the... » (*Interruption in French.*) We think that when you have to renew track with short rails, you will use more sleepers than have been used to date.

Mr. Dean. — No.

Mr. Feyrabend (in French). — We must go back to the sentence that was suggested.

Mr. Jacops (in French). — Here it is : « The number of sleepers per kilometre is generally the same as on track laid with standard rails, unless the track is particularly... »

Mr. Crespo Mocerrea (in French). — Yes.

Mr. Nicolas (in French). — The sleeper spacing ?

Mr. Feyrabend (in French). — I am not very proud of my sentence, it is not very clear.

Mr. Vaubourdolle (in French). — It lends itself to an interpretation.

Mr. Dunton. — Is it possible to give an approximate figure of the number of sleepers ?

Mr. Feyrabend (in French). — Give a figure of 1 500 at least. That would not upset anyone.

Mr. Jacops (in French). — « The number of sleepers per kilometre is generally the same as on track laid with standard rails, *provided they are at least 1 500.* »

Mr. Feyrabend (in French). — Agreed.

Mr. Jacops. — Did you understand, Mr. DUNTON ?

Mr. Dunton. — That is all right.

Mr. Crespo Mocerrea (in French). — I do not like this. Why say 1 500 ? What good does it do ?

Mr. Feyrabend (in French). — How many do you use ?

Mr. Crespo Mocerrea (in French). — 1 667 or 1 750.

Mr. Feyrabend (in French). — Then it does not affect you. It is a question of fact. No one uses less than 1 500.

Mr. Cividalli (in French). — What about narrow gauge lines ?

Mr. Josse (in French). — 1 500 to 1 700.

Mr. Feyrabend (in French). — In Italy, the number is 1 550. Consequently...

Mr. Jacops (in French). — I think we must settle the text of this summary : « The number of sleepers per kilometre is generally the same as on track laid with standard rails. » — or : « of standard length » ?

Mr. Josse (in French). — With short rails. Since we are speaking of long rails, the opposite would be short rails.

Mr. Feyrabend (in French). — Short ? Up to what length are they short ?

Mr. Nicolas (in French). — They are neither « standard » nor « substandard »; they are long.

Mr. Josse (in French). — Shall we say : « of ordinary length. »

Mr. Jacops (in French). — « The number of sleepers is generally the same as on lines with fishplated rails, provided there are at least 1 500... »

Mr. Feyrabend (in French). — Agreed in the case of fishplated rails.

Mr. Nicolas (in French). — « ... *When the sleeper spacing is equal to or more than 1 500...* » ?

Mr. Jacops (in French). — The text of Summary No. 6 will therefore be :

« Although the weight of concrete sleepers makes them more suitable for use in track laid with L.W.R., such rails can equally well be laid with complete safety on wood or metal sleepers. The number of sleepers per kilometre is generally the same as in tracks laid with fishplates, provided this number is at least 1 500. »

Mr. Feyrabend (in French). — In that case, we should delete the word « generally ».

Mr. Segretain, *Gafsa Railways, Tunisia* (in French). — I am not opposed to this summary, but I would not like it to be understood to mean that there are no L.W.R. with a sleeper spacing of less than 1 500; it is only 1 333 with concrete sleepers.

Mr. Jacobs (in French). — Without any drawbacks ?

Mr. Segretain (in French). — Without any drawbacks.

Mr. Feyrabend (in French). — Then, we must retain the word « generally ».

Mr. Crespo Mocorrea (in French). — Why give any figure ? It is not necessary.

Mr. Josse (in French). — We agree with you, Mr. CRESPO.

Mr. Jacobs (in French). — For the benefit of the English, otherwise they might lay their new rails with the old sleeper spacing ? (*The English Delegates signified their agreement.*)

— *The text adopted for Summary No. 6 is as follows :*

« 6. Although the weight of concrete sleepers makes them more suitable for use in tracks laid with L.W.R. such rails can equally well be laid with complete safety on wooden or metal sleepers. The number of sleepers per kilometre is generally the same as in tracks laid with fishplates, always provided the number is at least 1 500. »

Mr. Jacobs. — *Summary No. 11 :*

11. The most suitable maintenance methods have not yet been finally perfected. But it has already been learnt that no work involving removal of the ballast from the line should be carried out when the temperature exceeds to any appreciable extent that at the time of laying or most recent adjustment. As regards the maintenance of the level, it is generally recommended to use mechanical tamping rather than shovel packing.

I think that the second sentence of the first paragraph might read : « ... at a temperature which considerably exceeds that at laying or when the *stresses were last released* » instead of : « or *most recent adjustment.* »

Mr. Dunton. — In the English text, I think we should say : « carried out by de-stressing ». We can carry out all these works by de-stressing the track.

Mr. Jacobs. — It would not appear to be possible in most cases.

Mr. Cividalli (in French). — There is a question which I should like to ask the French Railways who have laid a lot of these welded rails. When it is stated that no work involving removal of the

ballast should be carried out when the temperature considerably exceeds that of laying or the last adjustment, obviously it is necessary to know the temperature at laying and that of the last adjustment. When it is merely a question of trials, it is very simple; but is it possible to adhere to this rule when many L.W.R. are laid and consequently, there is a given temperature for each rail which varies according to laying conditions? You have a range of 24°.

Mr. Feyrabend (in French). — The point raised by Mr. CIVIDALLI is a very opportune one. I must confess that this is one thing we are very careful about, giving the staff adequate information to enable them to work according to the standards laid down here.

In fact, the combining of the laying temperature range and the differences, particularly wide below the laying temperature which we accept for maintenance, allow the most usual operations, which are levelling operations, to be carried out. So far, we have not had to remove the ballast or replace sleepers because these are new lines; but it is probable that when we will finally have to carry out such work, we will begin by only doing so during the winter so as to be sure that we are in the lower part of the temperature range. In reality, this is a question which we are carefully studying.

Mr. Dunton. — When it is necessary to remove ballast from the track then we use the adjustment devices, so that I would not say it is impossible to remove ballast from the track when the temperature is high. It is possible, but one must

first distress the rail. It is not a recommended method but it can be done when necessary.

Mr. Jacobs (in French). — We have said, very prudently, that the most appropriate methods of maintenance have not yet been finally established. This is a fact.

Mr. Feyrabend (in French). — If the President will allow me, I should like to bring to your notice a text, a very brief one, from Mr. Robert LÉVI which makes his point of view regarding Summary No. 11 quite clear. Mr. LÉVI was unable to remain in Madrid to attend this meeting; this is an opinion given us by an acknowledged authority on the matter.

This is what he says :

« The last sentence of Summary No. 11 does not faithfully express the results of the experience acquired by Administrations, who generally make use of shovel packing for the maintenance of the levels.

« It is stated in the *Special Report* that shovel packing is blamed for favouring the transversal sliding of the track; this is true, but it is counterbalanced in the case of measured shovel packing by the regularity given to the sleeper bedding.

« The S.N.C.F., which has already laid more than 4 000 km of track with long rails, has never observed any defects in stability of the track after measured shovel packing, having made it quite clear that any work affecting the compactness of the ballast is forbidden when the temperature is high. On the other hand, they investigated, five years ago, the

question whether mechanical tamping was better than measured shovel packing in the case of L.W.R. as regards convenience or cost. After laying more than 500 km in 1953, on which maintenance by measured shovel packing was forbidden, they came to the conclusion that compared with L.W.R. maintained by the latter method, that this was the method to be preferred for L.W.R. just as for standard rails.

« It was also found that if, on lines with exceptionally heavy traffic, levelling had to take place at the beginning of the hot weather, in the case of isolated loose sleepers, the level could be restored by light mechanical tampers, without the gravel sleeper bed formerly used with shovel packing being disturbed.

« It would therefore be regrettable for this inaccurate sentence to remain in the final wording of Summary No. 11. »

Mr. Robert LÉVI then suggested the following text for Summary No. 11 :

« The most suitable maintenance methods have not yet been definitely determined, but the majority of Administrations adopt the same methods for L.W.R. as for rails of normal length. In general, it is agreed that no work involving removal of the ballast or lifting the track should be carried out when the temperature appreciably exceeds that at which the track was laid or last adjusted. »

Mr. Jacobs (in French). — And we would suppress the last sentence of the original summary ?

Mr. Josse (in French). — We might instead of « *last adjustment* » say : « *final*

adjustment » since this was the term used in Summary No. 9.

Mr. Feyrabend (in French). — I have no objection at it.

Mr. Dunton. — I would agree that with the word « *de-stressing* ».

Mr. Gardini, *Italian State Railways* (in French). — As far as tamping is concerned, I think the text of Summary No. 13 of Mr. CRESPO's report is all right as most Administrations use mechanical tamping and not shovel packing.

Mr. Crespo Mocerrea (in French). — That is not correct...

Mr. Feyrabend (in French). — If we examine the replies received, it is found that those Administrations who make use of tamping, also use it with long rails, and those who use shovel packing, also use shovel packing for their long rails.

Mr. Robert LÉVI has had the experience. In 1953, he decided that the long welded rails laid during that year would be maintained only by tamping. He certainly gave the order for this to be done, but he had to recognise that gradually those who carried out the work, in order to get a track of same quality to which they were used, had progressively to change over to shovel packing, even on those rails where he had given orders it was not to be used!

Mr. Crespo Mocerrea (in French). — We use shovel packing everywhere, with long rails as well, without any drawbacks.

Mr. Feyrabend (in French). — Our experience of the matter is quite a long one since we have been laying long rails for nine years, and we have used shovel packing for six or seven years.

Dr.-Ing. Schramm. — In Germany, we have used only little shovel packing for the past ten years. We have experience that track is not so good when we have measured shovel packing when speed is very high, and shovel packing is more expensive than when working with machine. In general, machines are cheaper than shovel packing.

Mr. Crespo Mocerrea (in French). — It depends on the country.

Mr. Feyrabend (in French). — Yes. This raises the general problem of maintenance and is outside the field of long rails.

Dr. SCHRAMM's remark agrees with **Mr. R. LÉVI's** idea, since **Dr. SCHRAMM** uses tamping with his long rails for the same reasons as he does for standard rails.

Mr. Crespo Mocerrea (in French). — Agreed.

Mr. Jacops (in French). — Then is shovel packing not forbidden?

Mr. Crespo Mocerrea (in French). — There is no reason why it should be forbidden.

Mr. Josse (in French). — It says in the summary: « The most suitable maintenance methods have not yet definitely been settled. » This leaves one to

suppose that there must be special methods for long rails. It appears from the discussions that all the Administrations make use of the same methods for long rails as for fish-plated rails, and that there are merely special precautions to be taken in the case of maintaining welded track.

I think we might slightly modify the summary by saying: « Special instructions — or precautions — for long welded rails have not yet been definitely settled, by all the Administrations, but generally... » Here would come the sentence about the work of removing the ballast and lifting the track, without saying, as in the original text, that the appropriate methods have not yet been definitely settled.

Mr. Feyrabend (in French). — In the text he proposed, **Mr. Robert LÉVI** was thinking not only of shovel packing, which he mentioned in the last part, but also of the other maintenance work, replacing rails, etc., which so far we have not had to undertake up to the present, as I said to **Mr. CIVIDALLI**.

Mr. Josse (in French). — As far as that is concerned, we have had the whole work to do: broken sleepers to replace, parts of rails to replace, etc. In practice, such work is simply the subject of a small chapter in the *General Instructions* on the maintenance of the line, which was settled some months ago; it simply states that such work must not be done when such and such a temperature is exceeded, but that for the remainder the work is to be done as usual. It is simply a question of taking precautions about the temperature.

Mr. Crespo Mocerrea (in French). — Obviously.

Mr. Jacops (in French). — Using the most suitable special precautions.

Mr. Feyrabend (in French). — By speaking of « special precautions » we are alluding to different things. Mr. JOSSE is alluding to work carried out on his railway where unfortunately some material had had to be replaced, I think on welded track.

Mr. Josse (in French). — There was simply a derailment; sleepers had to be replaced. Some concrete sleepers were cracked and had to be replaced.

Mr. Feyrabend (in French). — « Maintenance methods » is more general, which was why Mr. Robert LÉVI retained your expression, Mr. JACOBS, in the more general idea : « Special » leaves room for doubt. « Special instructions » may lead some very conscientious departments to state that you have not done everything necessary, as Mr. SCHRAMM stressed in an earlier discussion. I would like the expression « special precautions » or « special instructions » to be omitted.

Mr. Josse (in French). — That is the title of my chapter : « Special instructions ».

Mr. Feyrabend (in French). — That covers you, but it is not necessary for the whole world to follow!

Mr. Josse (in French). — You lay down a temperature slightly higher than the

temperature at laying; does this come to the same thing ?

Mr. Jacops (in French). — Is everyone in agreement about the proposed text ?

Mr. Lohmann. — Could you give us the English text ?

Mr. Glendinning gave the English translation of the text suggested by Mr. Robert LÉVI.

Mr. Feyrabend (in French). — We took « final adjustment » as the datum point. « Final » should be omitted from the text.

Mr. Legrand (in French). — The « last final adjustment » ? It is not the last; it has to be done several times.

Mr. Feyrabend (in French). — I agree.

Mr. Dunton. — I would wish to add to that « except where necessary by de-stressing ». « Except in cases of necessity by de-stressing. »

Mr. Feyrabend (in French). — « last release of stresses » ?

Mr. Jacops (in French). — « Except in cases where the stresses have to be released » ?

Mr. Feyrabend (in French). — That is no longer maintenance and we are talking of maintenance.

Mr. Jacops. — It is a question of maintenance when you talk of de-stressing.

There are some railways which have no adjustment devices. I think it is better to leave the text as it is.

Mr. Dunton. — It is a regular practice on our lines where there is urgent need.

Mr. Jacops. — Obviously, when it is a matter of urgency.

Mr. Dunton. — Sometimes when weather is bad you cannot do the necessary maintenance work.

Mr. Feyrabend (in French). — Nor do we. This is no longer maintenance, I agree with you when... (*Continuing in English.*) In your case, the temperature variation is not so great because you are near the sea, but in some regions of France, the sea is a long way off.

Mr. Dunton. — Why ? It is still maintenance

Mr. Feyrabend (in French). — It is no longer maintenance; it is question of an incident.

Mr. Dunton. — For us, it is maintenance. Maintenance must continue in any case.

Mr. Jacops (in French). — The summary states : « It is agreed that no work involving the removal of the ballast nor the lifting of the track should be carried out at a temperature considerably exceeding that of laying or the last adjustment. » The de-stressing is in fact a method of operation; I think we can give up saying so.

Mr. Josse (in French). — It does not cover all the Administrations who have no expansion devices.

Mr. Jacops (in French). — Exactly.

Mr. Feyrabend (in French). — I think that is exceptional; it is due to the nature of the bed on which...

Mr. Dunton. — No. In England, the climate is not at all stable. Variations are very frequent...

Mr. Jacops (in French). — Supposing we add : « In certain particular cases, the de-stressing may be necessary » ?

Mr. Feyrabend (in French). — Oh, no. I consider that this is no longer maintenance.

Mr. Dunton. — You can always wait till the weather is right; in England, we might have to wait several years...

Mr. Jacops (in French). — What do you think ? Keep the text as it is ?

Mr. Feyrabend (in French). — Yes.

Mr. Josse (in French). — Yes, because if we introduce the idea of de-stressing, all the Administrations, and they are numerous, who do not use expansion devices will find themselves left in the air by this summary.

Mr. Jacops (in French). — Of course. (*Then continuing in English*) : If we speak of de-stressing then the German Railways are pre-cluded. It is better, I think, not to speak of it.

Therefore, we will say :

« 11. The most suitable methods of maintenance have not yet been definitely determined, but the majority of the Administrations adopt the same methods for L.W.R. as they do for rails of normal length. In general, it is agreed that no work involving removal of the ballast, or lifting the track, should be carried out, when the temperature appreciably exceeds that at which the track was laid in or most recently adjusted. »

— *Summary No. 11 was adopted with this wording.*

Mr. Jacops (in French) :

Summary No. 12 :

12. Administrations with a certain experience of L.W.R. are agreed that the safety of the traffic over L.W.R. is fully assured.

Mr. Dunton. — Provided adequate maintenance is applied.

Mr. Jacops (in French). — It will therefore be necessary to add : « provided suitable maintenance methods are used. »

Mr. Feyrabend (in French). — No, that contradicts the text.

Mr. Jacops (in French). — I have a personal suggestion to make; that is to suppress Summary No. 12, which to some extent merely doubles Summary No. 2.

Mr. Feyrabend (in French). — I agree.

The President (in French). — Does everyone agree ? (*Agreed.*)

— *Summary No. 12 was therefore suppressed.*

Mr. Jacops (in French). — As no doubt you will remember, Gentlemen, we still have to examine Summary No. 1 which was left aside, the original text of which read as follows :

« 1. The name and characteristics of « long welded rails » (L.W.R.) are given to continuous rails of at least 100 m, whatever method is used to assemble them. » We have already discussed this text at length; in fact, the definition of « long welded rails » is given in the Questionnaire itself :

« After what length of rail does your Administration use the term « long welded rail » (L.W.R.), it being understood that by this it is considered a rail the central part of which never undergoes any movement as a result of temperature variations ? »

I would like to ask you to remember this definition in Summary No. 1. Could we not say : « It being understood by « long welded rail » a rail the central part of which never undergoes any movement as a result of temperature variations, the minimum length of rail meeting this definition can be fixed at about — 100 m ? »

Mr. Feyrabend (in French). — We were agreed on the text then ?

Mr. Jacops (in French). — Perhaps the text is all right. But if it is taken from its context, in the case of those who only read the summaries...

Mr. Feyrabend (in French). — I have no objection to including this text in

the summaries; we were agreed, I think, on a length of 100 m.

Mr. Jacops (in French). — I will read it again : « In view of the fact that the name of « long welded rail » (L.W.R.) is given to a rail the central part of which never undergoes any movement as a result of variations in the temperature, the minimum length meeting this definition is of the order of 100 m. »

Mr. Klaren (in French). — I thought we had approved another text saying : « the minimum length is a function of conditions of climate, the ballast and the fastenings. » ?

Mr. Jacops (in French). — That is so.

Mr. Feyrabend (in French). — Some people asked for a figure to be given.

Mr. Jacops (in French). — We agree that it would be right to do so, but adding that this figure was not always the same for all Railways.

Do you think we should say : « The definition of this term depends both on the length... »

Mr. Feyrabend (in French). — That is not a definition.

Mr. Jacops (in French). — « The minimum length which corresponds to this definition depends on the section of the rail... » ?

Mr. Feyrabend (in French). — If everything must be enumerated, what does Mr. KLAREN suggest ?

Mr. Klaren (in French). — « ... the minimum length of which is a function of conditions of climate, the ballast... » But I would like, Gentlemen, to suggest something else : that we should not mention the fastenings in Summary No. 1, since in the text of Summary No. 5 you decided as proposed by Messrs. PORTMANN and DUNTON to say that all systems of fastening which assure firm and permanent contact can be used. Once such a definition of the systems of fastening has been adopted, in my opinion, it is superfluous to state that the minimum length depends upon the fastenings, since with such fastenings which assure a firm and permanent contact, only the resistance of the ballast against longitudinal movement has anything to do with the matter.

Mr. Feyrabend (in French). — In that case, we will have to go back to I do not know what summary dealing with the ballast.

Mr. Crespo Mocerrea (in French). — Do not talk of the ballast either here.

Mr. Klaren (in French). — But certainly, certainly, the ballast affects the resistance in this case.

Mr. Crespo Mocerrea (in French). — The fastening also affects it, if it is not good.

Mr. Klaren (in French). — We need good types of fastenings as Summary No. 5 says.

Mr. Feyrabend (in French). — Summary No. 7 deals with the ballast; Sum-

mary No. 3 with the climate. In fact, we are recapitulating, to cap it all.

Mr. Jacops (in French). — «... is a function of the climate, the ballast, and the fastenings. »

Mr. Feyrabend (in French). — Each of these factors is dealt with in a summary, so all three should be mentioned again or none of them.

Mr. Klaren (in French). — Even with good ballast, the length is a function of the ballast; with good fastenings, the length is no longer a function of the fastenings.

Mr. Jacops (in French). — It seems that it would be better to retain the three conditions : climate, ballast, fastenings to cap it all as Mr. FEYRABEND said. Is it necessary to give any figure ?

Mr. Feyrabend (in French). — «... generally this length is of the order of 100 m ». Is the word « minimum » really necessary in this sentence ?

Mr. Jacops (in French). — Would you prefer : «... *generally* this length is of the order of 100 m » ? Or : « *In normal cases...* » ?

Mr. Vaubourdolle (in French). — «... the minimum length meeting this definition is generally... »

Mr. Jacops (in French). — «... of the order of 100 m » ? The text will thus read :

« 1. The name of long welded rails (L.W.R.), is given to rails the central part of which never undergoes any movement due to temperature alterations. The minimum length fulfilling this condition depends on conditions of climate, ballast, and method of fixing the rails. Normally, this minimum length is of the order of 100 m. »

— *Adopted.*

The President (in French). — Gentlemen, I suggest that we meet again tomorrow morning at 9.30 a.m., just before the Plenary Session to confirm the minutes. (*Agreed.*)

— The meeting ended at 12 midday.

Meeting of the 7th October 1958.

PRESIDENT : Mr. F. PEREZ VILLAMIL.

— The meeting started at 9.30 a.m.

The President (in French). — Gentlemen, if you are agreeable, we will read the Summaries for Question 2 as modified at yesterday's meeting.

— *All the summaries adopted for Question 2 were read.*

The President (in French). — Gentlemen, have you any comments to make as regards the text of these summaries ?

Mr. Cividalli (in French). — I am wondering, Mr. President, whether the last words of Summary No.5 are quite appropriate. It says, in reality, that : « ... experience of this device (elastic dog spikes) is still insufficient at the present time for final judgement to be passed on them. » In my opinion, this word « final » is too absolute, moreover we have practically no final summaries!

Mr. Legrand (in French). — Could we leave out this word ?

Mr. Feyrabend (in French). — It is not important...

Mr. Cividalli (in French). — I think it would be better to leave it out.

Mr. Jacops (in French). — We all have our opinions — one way or another.

Mr. Cividalli (in French). — You can read through the text of all the summaries — I do not think there is a single one which is final. It is only in this case that the word « final » is used. In fact, it is simply a question of the wording.

Mr. Jacops (in French). — To say that experience is still insufficient for any judgement to be passed, means in fact nothing.

Mr. Feyrabend (in French). — We ought to have some opinion.

The President (in French). — Nothing is final, never.

Mr. Jacops (in French). — There are some Railways who have an opinion,

others a final judgement, which means that they are going on with L.W.R., whilst others are still hesitant about them...

Mr. Crespo Mocerrea (in French). — Does this simply concern the use of elastic spikes ?

Mr. Jacops (in French). — Yes. We could leave out the word « final ».

Mr. Dean. — We could pass a judgement. Any of us, who have experience can pass a judgement now, but we cannot pass a final one because we have not enough time. I could give an indication now, but it would not be a final one.

Mr. Jacops. — You prefer the word « final » ? Could we not think of some other word ?

Mr. Dunton. — We cannot think of an appropriate word. We might say « firm ».

Mr. Jacops. — I think it would be better to leave the text as it is.

Mr. Crespo Mocerrea (in French). — *An appropriate judgement ?*

Mr. Feyrabend (in French). — The word « final » is not inconvenient.

It is the British Railways who have the most experience in this matter; it is therefore the opinion of our English colleagues which is of the greatest value.

Mr. Jacops (in French). — I think the text should be left as it is, since it does not seem possible to amend it. (*Agreed.*)

Mr. Feyrabend (in French). — Mr. President, I should like a small correction to be made in the wording of Summary No. 3. In the last paragraph, it says : « The majority of the Administrations use L.W.R. in straight track and in curves the radius of which is not less... etc. » then : « The minimum radius... » Should we not say : « *This* minimum radius... » to make it clear that this sentence goes on from the preceeding one and thus assure continuity of ideas ?

Mr. Dunton. — Is it not referring to a minimum radius ? I would prefer to leave it as it is.

Mr. Feyrabend (in French). — I agree.

Mr. Jacops (in French). — So we will leave : « The minimum radius... »

Mr. Feyrabend (in French). — In the second sentence of Summary No. 4 : « Those who use these devices consider it necessary to de-stress the rails in case of difficulties. » Difficulties is in the plural; should it be plural or singular ?

Mr. Jacops (in French). — With the meaning our colleagues had in mind, it appears that it is in case of difficulty that this method is used. *This amendment does not concern the English text.*

Mr. Dunton. — I would like to raise a point on Summary No. 9. The first paragraph as it reads in the English, signifies that most Railways by their experience agree a temperature range up to 25° C. That would not apply to our system. I question whether it does apply

to most railways. I think perhaps 25° is peculiar to the French Railways and not to most railways.

Mr. Feyrabend (in French). — Up to 25°.

Mr. Jacops (in French). — « according to the experience of *several* Railways » it says in the French text. That might mean two Railways. In the English text it says : « most Railways... » There is therefore a difference between the French and English texts.

Mr. Dunton. — Do you mean « several » ?

Mr. Jacops (in French). — We will therefore say : « several » instead of : « most » in the English text.

The President (in French). — Gentlemen, if no one else has any comments to make, we can end these discussions.

Mr. Cividalli (in French). — I think, Gentlemen, that I am speaking for you all in thanking Mr. PEREZ VILLAMIL for having been good enough to preside over our discussions. (*Applause.*)

Mr. Lohmann. — Before you close the session of the Section, I should like to say a few words of thanks to Mr. JACOBS. We know it is very difficult to speak a foreign language, and translate. Often we do not say a lot, and sometimes we do not say anything because we do not know what to say, but Mr. JACOBS he knows and what is more he translates as well and makes the final conclusions, and in my opinion he has done excellently. (*Applause.*)

Mr. Vaubourdolle (in French). — In the name of the French speaking Delegates, I wish to join in the thanks which Mr. LOHMANN has just expressed to Mr. JACOPS. He has led the discussions on long rails magnificently; there is no doubt that it is to his efforts that we owe the clear wording of the text of our summaries. (*Further applause.*)

The President (in French). — Gentlemen, this brings us to the end of our work, so that we can now bring this meeting to an end. I wish to thank you all for your kind collaboration in our discussions, which have proved most fruitful. I wish you a pleasant conclusion to the Congress and a good journey home.

— The meeting ended at 10 a.m.

DISCUSSION AT THE PLENARY SESSION.

Meeting of the 7th October 1958.

PRESIDENT : Sr. D. AGUSTÍN PLANA.

GENERAL SECRETARIES : MESSRS. P. GHILAIN and J. PÉREZ POZUELO.

The President (in French). — The second point on our agenda is the approval of the summaries adopted by the various Sections since the Plenary Meeting of the 3rd October.

Will Mr. GHILAIN please be good enough to read these.

Mr. Ghilain, General Secretary (in French). — First of all we have Question 2, the summaries for which adopted at the Section Meetings were published in No. 6 of the *Daily Journal of the Congress*.

— *The reading of these summaries did not give rise to any comments.*

The President (in French). — We will therefore consider the Summaries for Question 2 as approved.

SUMMARIES.

« 1. The name of long welded rails
« (L. W. R.) is given to rails the central
« part of which never undergoes any
« movement due to temperature altera-
« tions. The minimum length fulfilling
« this condition depends on conditions
« of climate, ballast, and method of fix-
« ing the rails. Normally, this minimum
« length is of the order of 100 metres.

« 2. At the present time long welded
« rails have undergone the test of nine
« years' service in various climates, on
« lines with the heaviest and fastest
« traffic, without causing undue diffi-
« culty. They are the best solution
« known today for obtaining at one and
« the same time smooth running, good
« preservation of the track and of the
« rolling stock, and for reducing consi-
« derably the maintenance costs.

« 3. From the theoretical point of
« view, there are no limits to the length
« of L. W. R., for this reason the deter-
« mination of the actual continuous
« length the most suitable in practice is
« based on practical considerations.
« These have not been judged in the
« same way by the different Adminis-
« trations.

« Certain Railways fix this length
« simply in accordance with operating
« requirements (track equipment, such
« as insulated joints and switches and
« crossings), whereas others consider
« that it is not desirable to exceed a
« length of 800 to 1 000 metres.

« The majority of Railways use long
« welded rails in straight track and in
« curves of which the radius is not less

« than 500 to 800 metres, according to
« the type of sleepers used. The mini-
« mum radius varies in accordance with
« climatic conditions and the materials
« used in the track. In particularly fa-
« vourable conditions certain Railways
« come down to curves of a radius less
« than 200 metres.

« 4. The use of devices for the initial
« adjustment and the subsequent adjust-
« ment or de-stressing of the rails de-
« pends upon the practices of each
« Administration. The Administrations
« which use these devices consider it
« necessary to de-stress rails in cases of
« difficulty.

« Other Administrations, on the con-
« trary, consider that normal fishplating,
« together with a large number of anti-
« creep devices, give satisfaction.

« 5. All types of fastening which
« assure firm and permanent connection
« between the rail and the sleeper can
« be used with L. W. R. As far as
« elastic rail-spikes are concerned, ex-
« perience of this type of fastening is
« insufficient at the present time for a
« final judgment to be passed.

« 6. Although the weight of concrete
« sleepers makes them more suitable for
« use in tracks laid with L. W. R. such
« rails can equally well be laid with
« complete safety on wooden or metal
« sleepers. The number of sleepers per
« kilometre is generally the same as in
« tracks laid with fishplates, always
« provided the number is at least 1 500.

« 7. The ballast should consist of
« hard, sharp elements, of between 25
« and 60 mm in size.

« Wide and full ballast profiles must
« be provided and maintained.

« 8. The method preferred where pos-
« sible for making L. W. R. is to flash-
« butt weld in the shops the longest
« lengths of rail that can be welded,
« transport these to their destination on
« suitable rakes, and join them together
« on the site by the most suitable
« method. For the latter, the most
« widely used method is thermit welding.
« The majority of Administrations agree
« that the two welding processes cited
« above do not need any subsequent heat
« treatment.

« 9. The final tightening of L. W. R.
« should be made within a pre-deter-
« mined temperature range, which ac-
« cording to the experience of several
« Railways may be rather wide (up to
« 25° centigrade).

« The mean of this range should equal
« or exceed the mean annual tempera-
« ture of the rail.

« If at the time of laying the track
« the fastenings have been tightened
« outside the desired range of tempera-
« tures, it is recommended that de-
« stressing should be carried out, fol-
« lowed by a new tightening, when the
« required conditions are fulfilled.

« 10. The maximum speeds allowed
« on lines laid with L. W. R. are the
« same as those allowed on lines laid
« with standard length rails.

« Likewise the speed restrictions on
« newly laid L. W. R. are similar to
« those laid down for newly laid classic
« type lines.

« 11. The most suitable methods of
« maintenance have not yet been defi-
« nitely determined, but the majority of
« the Administrations adopt the same
« methods for L. W. R. as they do for
« rails of normal length. In general it

« is agreed that no work involving
« removal of the ballast, or lifting the
« track, should be carried out, when the
« temperature appreciably exceeds that
« at which the track was laid in or most
« recently adjusted. »

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